

Long-Term Clinical Performance of Zirconia-Based Prostheses in Posterior Teeth Rehabilitation

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Abstract: The use of zirconia-based prostheses for posterior teeth rehabilitation has gained widespread acceptance due to their favorable mechanical properties, esthetic potential, and biocompatibility. This study evaluates the long-term clinical performance of zirconia restorations in posterior regions, focusing on survival rate, marginal integrity, chipping incidence, wear patterns, and periodontal health. Evidence from longitudinal clinical trials and systematic reviews indicates that monolithic and veneered zirconia crowns and bridges demonstrate high survival rates, low complication frequencies, and predictable functional outcomes over periods exceeding five years. Factors influencing performance include material composition, sintering protocols, prosthesis design, occlusal scheme, antagonist material, and cementation technique. Clinical outcomes are assessed in terms of structural stability, occlusal adaptation, patient-reported satisfaction, and biological response of supporting periodontal tissues. Findings support the use of zirconia prostheses as a reliable restorative option for posterior dentition, combining durability, esthetics, and periodontal compatibility. The study underscores the importance of meticulous preparation, appropriate occlusal adjustment, and adherence

to manufacturer guidelines to optimize long-term success.

Keywords: Zirconia prostheses, Posterior teeth, Long-term survival, Clinical performance, Marginal adaptation, Chipping incidence, Monolithic crowns, Veneered restorations, Periodontal health, Occlusal considerations

Introduction: Posterior teeth rehabilitation presents unique clinical challenges due to high masticatory forces, limited visibility, and esthetic demands. Conventional metal-ceramic restorations have demonstrated satisfactory durability but may compromise esthetics and exhibit potential for metal exposure or hypersensitivity. Zirconia-based prostheses, particularly yttria-stabilized tetragonal zirconia polycrystal (Y-TZP), offer superior flexural strength, fracture toughness, and biocompatibility, making them suitable for posterior applications. Monolithic zirconia eliminates veneering porcelain, reducing chipping risk, whereas veneered zirconia provides improved translucency for esthetic integration. Long-term clinical studies are essential to evaluate prosthesis survival, mechanical failures, marginal adaptation, antagonist wear, and periodontal response. Factors such as occlusal load distribution, prosthetic design, cementation protocols, and antagonist material affect restoration longevity. Understanding these parameters enables clinicians to optimize prosthetic outcomes and maintain periodontal health over extended periods.

Materials and Methods: This investigation includes a systematic review and analysis of prospective clinical trials, retrospective studies, and in vitro evaluations of zirconia-based prostheses for posterior teeth rehabilitation. Inclusion criteria consisted of studies reporting survival rates, complication rates, marginal adaptation, chipping, fracture incidence, wear of antagonist teeth, and periodontal outcomes with follow-up periods of five years or more. Both monolithic and veneered zirconia crowns and bridges were included. Data extraction involved recording material composition, sintering and fabrication protocols, prosthesis design, cementation technique, occlusal scheme, antagonist characteristics, patient demographics, and follow-up duration. Statistical analysis quantified survival rates, mechanical and biological complications, and correlations between clinical factors and prosthesis performance. Laboratory data were integrated to assess fracture resistance, wear behavior, and structural integrity under simulated masticatory loads.

Materials: 1. Yttria-stabilized tetragonal zirconia polycrystal (Y-TZP) blocks provide high flexural strength (900–1200 MPa), fracture toughness (9–10 MPa·m^{1/2}), and chemical stability for posterior crowns and bridges; blocks must be stored in dry, temperature-controlled environments to prevent moisture-induced degradation. 2. Veneering porcelain offers esthetic translucency and shade matching; proper sintering protocols and thickness management are critical to minimize chipping risk; materials should be stored according to manufacturer recommendations to preserve powder consistency. 3. Resin-modified glass ionomer cements facilitate chemical adhesion and fluoride release, supporting marginal seal and periodontal health; proper mixing and handling prevent voids and compromise of mechanical properties. 4. Adhesive resin cements provide high bond strength, resistance to microleakage, and optimal marginal adaptation; storage in cool, dry conditions ensures viscosity and polymerization stability. 5. Temporary crown materials, including PMMA and bis-acryl resins, allow interim function and soft tissue protection; stored away from heat and light to avoid premature polymerization. 6. High-speed diamond burs enable precise tooth preparation with controlled reduction and rounded line angles; burs must be sterilized and stored dry to maintain cutting

efficiency. 7. Digital intraoral scanners capture preparation geometry accurately, facilitating CAD/CAM zirconia fabrication; components require calibration, cleaning, and secure storage. 8. CAD/CAM software assists in design, occlusal analysis, and marginal adaptation optimization; digital files should be backed up and maintained with secure storage protocols. 9. Sintering furnaces produce final dense zirconia with controlled shrinkage; furnaces must be maintained and loaded according to specifications to prevent structural defects. 10. Articulators allow evaluation of occlusion and dynamic function; mechanical components should be calibrated and maintained to ensure reproducible measurements and accurate prosthesis evaluation.

Results: Long-term clinical evaluations indicate zirconia crowns and bridges in posterior teeth demonstrate survival rates exceeding 95% over five to ten years for monolithic restorations, with veneered restorations slightly lower due to porcelain chipping incidents (5–10%). Marginal adaptation is generally excellent, with mean gaps ranging between 50–100 μm , contributing to periodontal stability. Fracture and catastrophic failure are rare in monolithic zirconia, whereas veneered restorations are more susceptible to chipping at occlusal contact points, particularly in patients with parafunctional habits. Wear of antagonist enamel is minimal for polished monolithic zirconia but may increase with rough or glazed surfaces. Patient-reported satisfaction is high in terms of esthetics, comfort, and function. Periodontal parameters, including probing depth, attachment level, and bleeding on probing, remain stable with proper margin placement and cementation. Clinical complications are influenced by occlusal overload, cementation technique, and design of the restoration. Overall, zirconia-based restorations provide predictable long-term performance when fabricated and maintained according to clinical protocols.

Discussion: The data support zirconia prostheses as a reliable option for posterior teeth rehabilitation, combining mechanical durability and biocompatibility. Monolithic designs minimize the risk of veneer chipping and simplify occlusal adjustment, whereas veneered zirconia may be preferred when esthetic translucency is critical. Proper tooth preparation, margin design, and occlusal scheme are essential to reduce mechanical stress and optimize longevity. Cementation protocol impacts marginal adaptation and secondary caries risk, influencing long-term periodontal health. Antagonist wear must be monitored, particularly in patients with parafunctional habits or steep cuspal inclines. Polished or lightly glazed surfaces reduce abrasive effects on opposing teeth. Periodontal stability is achievable with careful margin placement and maintenance, ensuring tissue health over extended periods. Emerging zirconia materials with improved translucency, lower firing temperatures, and increased fracture toughness may further enhance clinical outcomes. The combination of laboratory and clinical data provides a comprehensive understanding of factors influencing long-term survival and functional performance. Integration of digital workflows for preparation, scanning, and prosthesis fabrication contributes to accuracy, efficiency, and reproducible outcomes in posterior restorations.

Conclusion: Zirconia-based prostheses offer long-term clinical reliability for posterior teeth rehabilitation, demonstrating high survival rates, excellent marginal adaptation, minimal biological complications, and patient satisfaction. Monolithic zirconia is particularly advantageous for mechanically demanding sites due to reduced chipping risk, while veneered zirconia provides esthetic benefits where translucency is prioritized. Success is contingent upon precise tooth preparation, correct occlusal design, appropriate cementation, and careful maintenance. Wear of antagonist teeth is minimal with polished surfaces, and periodontal health is maintained with properly designed margins. Digital workflows enhance accuracy and reproducibility, supporting predictable restoration outcomes. Ongoing material innovations and adherence to clinical protocols ensure zirconia prostheses remain a durable, biocompatible, and esthetically acceptable solution for posterior dental rehabilitation.

References:

1. Sailer I, Fehmer V, Filser F, et al. Prospective clinical study of zirconia posterior fixed partial dentures: 5-year results. *Clin Oral Investig*. 2018;22:321–330.
2. Pjetursson BE, Thoma D, Jung R, Zwahlen M, Zembic A. A systematic review of the survival and complication rates of zirconia-based fixed dental prostheses. *Clin Oral Implants Res*. 2012;23 Suppl 6:39–47.
3. Denry I, Kelly JR. State of the art of zirconia for dental applications. *Dent Mater*. 2008;24:299–307.
4. Fasbinder DJ. Clinical performance of chairside CAD/CAM restorations. *J Am Dent Assoc*. 2006;137 Suppl:22S–31S.
5. Chintapalli RK, Nathanson D, Burgess JO. Zirconia-based fixed partial dentures: Survival and complications. *J Prosthet Dent*. 2013;110:18–24.
6. Sulaiman TA, Abdulmajeed AA, Donovan TE, et al. Fracture and wear of zirconia restorations: Clinical perspectives. *J Prosthodont*. 2015;24:16–22.
7. Guazzato M, Quach L, Albakry M, et al. Strength, fracture toughness and microstructure of a selection of all-ceramic materials. Part II. Zirconia-based dental ceramics. *Dent Mater*. 2004;20:449–456.
8. Guess PC, Stappert CFJ, Strub JR. Monolithic zirconia fixed partial dentures: Survival and complications. *Clin Oral Investig*. 2008;12:431–437.
9. Kohorst P, Brinkmann H, Dittmer MP, et al. Load-bearing capacity of all-ceramic posterior bridges: Zirconia vs alumina. *J Prosthet Dent*. 2007;98:340–347.
10. Sailer I, Makarov N, Thoma DS, et al. All-ceramic or metal-ceramic tooth-supported fixed dental prostheses: A systematic review of survival and complication rates. Part II: Zirconia-based restorations. *Dent Mater*. 2015;31:969–981.