

What is the Success and Survival outcomes of PFM vs. All Ceramic FDP's: A Review of the Literature

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INTRODUCTION

Fixed dental prosthesis is a favored prosthetic option while restoring small and large edentulous spaces in the dentition. It is a viable treatment and has long been considered the gold standard of treatment options while restoring form, function, phonetics, and esthetics. It can also be cost-friendly in comparison to long-spanning implant-retained bridges and/or multiple adjacent single-unit implants. Long-spanning bridges are versatile and can be made from different materials including porcelain-fused-to-metal, all ceramic/zirconia, porcelain-fused-to-zirconia, and even implant-retained bridges depending on the size of the edentulous area. There has been a large transition from PFM single-unit crowns to all ceramic/zirconia single-unit crowns but can this success be applied to bridges as well? This topic is incredibly significant because as providers, we must know the indications and contraindications, as well as pros/cons of every material we work with. In addition, we must be able to evaluate when a specific material may be a better fit in terms of prosthetic treatment for a particular case.

Zirconia



Zirconia is at the top of dental biomaterials because it is one of the strongest non-metallic materials. It has the ability to resist fractures and stop crack propagation. Due to its ability to resist masticatory forces

and bruxism, it is a preferred material for posterior single-unit crowns and implant crowns. It has excellent aesthetic properties and is preferred in the anterior aesthetic zone as compared to its PFM counterpart. It also happens to be more biocompatible because there is no risk of metal allergy.

Porcelain Fused to Metal



PFM crowns have been considered the gold standard of dental biomaterials for restorative and prosthetic use. The internal surface is made up of metal which is

favorable in terms of strength while the external surface has a layer of porcelain which is favorable in terms aesthetics. PFM crowns can last for decades. In addition, they tend to be a cost-friendlier option as compared to their all-ceramic counterparts.

LITERATURE REVIEW ARTICLE 1

The first systematic review I appraised "All-ceramic or metal-ceramic tooth-supported fixed dental prostheses (FDPs)? A systematic review of the survival and complication rates. Part II: Multiple-unit FDPs" (Pjeturrson, 2015) aimed to compare various factors of metal-ceramic vs. all ceramic FDP's over a period of three to five years. During the search strategy, the researchers looked at three different databases including Medline, Cochrane, and Embase for relevant studies from 2006-2013. They only included studies that were published in English. In terms of inclusion criteria, the researchers included studies that had "followed at least 10 patients with FDP's for over 3 years, randomized control trials, clinical control trials, prospective case series, retrospective studies, patients that could be clinically examined, and details on materials of FDP, methods, and results" (Pjeturrson, 2015, pg. 627). During the selection process of the articles, there were only two reviewers. The original search yielded a little under 600 results but only 70 of these were agreed on by both reviewers. Following inclusion/exclusion criteria, a total of 40 articles were officially included in the study. The reviewers were comparing various materials such as metal-ceramic, glass ceramic, glass-infiltrated alumina, and sintered zirconia (Pjeturrson, 2015, pg. 632). In addition, the reviewers were comparing "multiple factors including survival, failure, and various complications including recurrent decay, root fractures, framework fractures, chipping, etc." (Pjeturrson, 2015, pg. 629). In terms of results, "15 studies assessed survival rates of 1796 metal-ceramic FDP's and found that 94.4% survived, 16 studies assessed survival rates of 673 sintered zirconia FDP's and found that 90.4% survived, 7 studies assessed survival rates of 208 reinforced glass ceramic FDP's and found that 89.1% survived, and 6 studies assessed survival rates of 229 glass infiltrated alumina and found that 86.2% survived- all of these following a 5-year period" (Pjeturrson, 2015, pg. 630). From these results, there seems to be a greater survival rate of metal-ceramic FDP's as compared to all-ceramic. However, a limitation here was that none of these results except the glass infiltrated alumina were statistically significant. Another factor that was assessed is "the rate of decay recurrence on abutment teeth between these materials and it was found the lowest rate of 0.11% was associated with reinforced glass ceramics while the highest rate of 0.65% was associated with sintered zirconia, a value that was found to be statistically significant (p-value=0.001)" (Pjeturrson, 2015, pg. 633). A third important factor that was assessed was loss of retention and it was found that "sintered zirconia had the greatest rate of loss of retention at 3.1% over a 5-year period" (Pjeturrson, 2015, pg. 636). This value was also found to be statistically significant. Overall, metal-ceramic FDP's did show to have a smaller failure rate as compared to all ceramic FDP's.

LITERATURE REVIEW ARTICLE 2

The second systematic review I appraised "Survival of Zirconia-and Metal-Supported Fixed Dental Prosthesis: A Systematic Review" aimed to compare fracture of FDP core as well as veneer chipping in Zirconia and PFM FDP's (Heintze, 2010, pg. 493). During the search strategy, the researchers searched Pubmed, SCOPUS database, and published articles. Some of the inclusion criteria was "prospective clinical trials of at least 2 years, fracture of framework, chipping of veneer material, debonding, etc. while some important exclusion criteria was FDP failures caused by biologic reasons such as endodontic treatment and periodontal inflammation" (Heintze, 2010, pg. 494). I believe this is a strength of this article as opposed to the first article because it eliminates confounding variables. Although the degree of veneer chipping is not the primary factor I was looking into, a large degree of chipping could cause replacement of an FDP so it is still something to consider. To assess the degree of veneer chipping, a scale was used from 1-3 with 1 referring to a small chip that required no treatment and 3 referring to a chipping that is so severe that the whole FDP needed to be replaced. In terms of the results, "out of 595 FDP's, only 5 zirconia FDP's had core fractures which was less than 1% while no metal FDP's had core fractures" (Heintze, 2010, pg. 497). In comparison, the result for "veneering chipping between zirconia and PFM FDP's, it was determined that there is a much higher rate of chipping for zirconia rather than PFM" and this value was statistically significant (P<0.001). This article did not provide substantial evidence on the more important factors of Zirconia vs. PFM FDP's such as success, failure, and longevity.

LITERATURE REVIEW ARTICLE 3

Another important consideration when assessing long-spanning FDP's is assessing if Zirconia can have any adverse effects on the opposing dentition. Although this next article does not answer my clinical question directly, I still believe it is clinically relevant. The third article "Wear in Antagonist Teeth Produced by Monolithic Zirconia Crowns: A Systematic Review and Meta-Analysis" aimed to assess "the level of wear that can occur in opposing teeth of full coverage prosthetic restorations or zirconia supported crowns in the short and medium term" (Solá-Ruiz, 2020, pg. 1). During the search strategy, the researchers searched Pubmed, Scopus, Cochrane, WOS, and Embase. There was no language restriction during the search which I believe is a stronger characteristic than the first article because it did not unnecessarily exclude clinically relevant articles based on language alone. Inclusion criteria included "clinical trials, case control studies, and cohort studies while exclusion criteria eliminated in vitro studies and studies that contained opinions" (Solá-Ruiz, 2020, pg. 3). I believe the exclusion criteria is a strength of this article because removing articles that contain opinions reduces bias. From the 357 articles found, only 8 were included in the study. Although this is not a large amount of data, 7 of the 8 were based on clinical trials so I do feel there is greater clinical applicability. In addition, the "Newcastle-Ottawa Quality Evaluation Scale was used to assess quality of each based on a score from 0-11 with 5 referring to studies of high quality and low risk of bias" and 6 of the article scored higher than 5 which is an indicating factor to the quality of evidence presented (Solá-Ruiz, 2020, pg. 3 and 4). The studies assessed occlusal/enamel wear and/or complications of opposing teeth of zirconia crowns. Adjacent teeth were used as a control. "Two studies indicated that there is a higher rate of wear on opposing teeth from zirconia restorations to that of the control with a p-value that was statistically significant, one study had no difference, another study only provides a value for amount of wear in opposing teeth, a fourth study specifically measured the amount of wear via attrition and found that 6.12% of zirconia crowns produced grade 1 and 2 attrition (Grade 2 attrition is measured by having light wear in dentin). In addition two of the studies detected anatomical changes as well as noting fissures/cracks in 10.24% of cases and attrition in 24.14% of cases in the crowns of opposing teeth" (Solá-Ruiz, 2020, pg. 9). Another study measured the amount of wear in antagonist teeth comparing zirconia and metal-ceramic crowns and results stated, "the wear on the antagonist teeth of metal-ceramic crowns were greater than antagonist teeth of zirconia crowns at 6 months but less than at 12 months" (Solá-Ruiz, 2020, pg. 14). In addition, the article discussed that various factors have to be considered aside from just wear like the region that the crowns are being placed. One study concluded that "wear is greater in the posterior region rather than more anteriorly because masticatory and occlusal forces are greater in the molar region as opposed to the premolar region" (Solá-Ruiz, 2020, pg. 14). Although the methodology was incredibly strong in this study and certain results can be considered during treatment planning, to be able to clinically apply this information, this study has to be done on a larger population scale and for a greater follow-up period. In addition, no causation can be made because this article explored crowns and not FDP's.

Conclusion

Based on the three articles, it was evident that although the transition has been made from PFM crowns to Zirconia crowns, PFM bridges still remain the gold standard. Based on the first article, there was a larger percentage of survival of PFM FDP's rather than zirconia and all ceramic FDPs. In addition, there was a greater rate of retention loss and recurrent decay with Zirconia (Pjeturrson, 2015). The second article discussed there being a larger rate of core fracture with Zirconia FDP's as opposed to PFM as well as veneer chipping (Heintze, 2010). The third article discussed the effects of Zirconia on the wear of opposing teeth and found that Zirconia does cause attrition, wear and changes to the crown surface (Solá-Ruiz, 2020). In summary, despite the various limitations of each article, a general consensus based on the literature can be made that PFM bridges are still superior than all ceramic/zirconia bridges. However, choosing a dental material for prosthetic and restorative options must include other factors such as a amount of tooth structure that remains, restorability, abutment longevity, size of the edentulous space, the current status of a patient's occlusion, aesthetic concerns, financial concerns, etc. This information can be useful in its clinical applicability if it is considered on a specific case by case basis.

References

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