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Zirconia VS PFM in Long Span Bridges

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OKU Sutro Excellence Day Project Cover Sheet

Project Title

Zirconia VS PFM in Long Span Bridges

Full name(s) and class year(s) of all project collaborators

Example: Jane Smith, DDS 2022; John Smith, DDS 2022

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Project Category

IDS - 1st Year Literature Review

Enter your abstract text here (max 300 words)

Objectives:
1. Compare the basic properties of Zirconia and Porcelain-Fused-to-Metal (PFM) in dental prostheses.
2. Assess the rates of technical complications like fracture, chipping and biological outcomes between Zirconia and PFM prosthesis.
3. Investigate the survival rates of Zirconia-based fixed dental prosthesis (FDPs) versus PFM FDPs.
4. Evaluate the suitability of Zirconia and PFM for long-span bridges, considering strength, durability, aesthetics and its effects.
Methods:
1. Conducted systematic research on peer-reviewed articles from websites such as embase, pubMed, google scholar and ovid medline comparing Zirconia Vs PFM.
2. Selected studies evaluating mechanical properties, aesthetics, biocompatibility, clinical outcomes and survival rates.
3. Extracted data on biological outcomes, technical outcomes, and survival rates from selected studies.
4. Analyzed data to identify trends and differences between materials in prosthesis as well as in long span bridges.
Results:
Zirconia exhibits superior mechanical properties and biocompatibility as compared to PFM prosthesis. Limited long-term data is available for the long-span FDPs, however, existing evidence suggests somewhat similar 10-year survival rates in both zirconia as well as PFM. Despite the similarity, zirconia emerged as a promising PFM alternative with superior mechanical properties, durability, and aesthetics. Regardless of the material if the prosthesis is >5 units, it is inevitably associated with higher technical complication rates as compared to the shorter span bridges.
Conclusion:
While requiring more long-term data, Zirconia long-span FDPs displayed comparable 10-year survival rates as PFM with zirconia being a slightly better option for longer span bridges due to its great strength, durability, and aesthetics.

Acknowledgements:

Zirconia vs PFM in Long Span Bridges

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SCAN ME
FOR REFERENCES

OBJECTIVE

1. Compare **the basic properties** of Zirconia and Porcelain-Fused-to-Metal (PFM) in dental prostheses.
2. Assess the **rates of technical complications like fracture, chipping and biological outcomes** between Zirconia and PFM prosthesis.
3. Investigate the **survival rates of Zirconia-based fixed dental prosthesis (FDPs) versus PFM FDPs**.
4. Evaluate **the suitability of Zirconia and PFM for long-span bridges**, considering strength, durability, aesthetics and its effects.

METHODS

1. Systematic research on peer-reviewed articles from Embase, PubMed and Google Scholar. Studies between 2010 and 2024 were evaluated that performed clinical studies with a mean follow-up rate of at least 5 years.
2. Selected studies evaluating technical outcome, aesthetics, biocompatibility, clinical outcomes and survival rates.
3. Extracted data on biological outcomes, technical outcomes, and survival rates from selected studies.
4. Analyzed data to identify trends and differences between materials in prosthesis as well as in long span bridges.

TECHNICAL OUTCOMES

1. Posterior Zirconia Crown (ZC) and Metal Crown (MC) FDPs exhibited **excellent 10-year survival rates with no statistical differences between the groups**
2. Minor **superficial chipping of the veneering ceramic occurred similarly at ZC and MC**, yet **clinically inacceptable major fractures of the veneering ceramic only observed for ZC FDPs**
3. More frequent de-bonding with ZC FDPs
4. **More clinically unacceptable marginal adaption clinically with ZC FDPs compared to MC FDPs.**

BIOLOGICAL OUTCOMES

1. *Both types of FDPs exhibited favorable results with **no differences between the groups for the majority of the assessed periodontal parameters (p>0.05).***
2. *A **slightly higher rate for secondary caries** in the marginal areas of the FDPs was found at the ZC abutment teeth than at the MC abutment teeth.*
3. ***Zirconia frameworks exhibited significantly larger internal gaps** than the metal frameworks in cervical, axial and occlusal regions.*
4. *The **biologic integration** of the zirconia-ceramic and the metal-ceramic FDPs **was similar at 10 years.***
5. ***No differences in the periodontal parameters (PD, PAL and BOP)** were found, and loss of vitality occurred similarly in both groups.*

LONG SPAN vs SHORT SPAN

- *Long span (5 units or more) cause excessive load on abutment teeth & periodontal area causing bridge fractures and periodontal problems.*

Year	Long span	Short span
In year 5	85%	91%
In year 10	50%	68%
In year 15	18%	34%

Complication	Number of abutments or FDPs	Estimated annual complication rates (95% CI)	Cumulative 5 year complication rates (95% CI)	Number of abutments or FDPs	Estimated annual complication rates (95% CI)	Cumulative 5 year complication rates (95% CI)
	Metal ceramic FDPs			Reinforced glass ceramic FDPs		
Caries on abutments	2497	0.24* (0.10–0.57)	1.2%* (0.5–2.8%)	199	0.12* (0.01–1.27)	0.6%* (0.06–6.2%)
FDPs lost due to caries	1053	0.54* (0.24–1.22)	2.7%* (1.2–5.9%)	118	0.12* (0.01–1.29)	0.6%* (0.06–6.2%)
FDPs lost due to periodontal disease	1004	0.06* (0.03–0.11)	0.3%* (0.1–0.6%)	118	0.87* (0.14–5.53)	4.3%* (0.7–24.1%)
FDPs lost due to abutment tooth fracture	1053	0.19* (0.11–0.30)	0.9%* (0.6–1.5%)	118	0.12* (0.03–0.53)	0.6%* (0.1–2.6%)
Loss of abutment tooth vitality	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Marginal discolorations	20	4.82* (1.33–11.88)	21.4%* (6.4–44.8%)	118	0.72.* (0.23–2.19)	3.5%* (1.2–10.4%)
Framework fracture	1530	0.12* (0.04–0.40)	0.6%* (0.2–2.0%)	136	2.14* (1.0–4.74)	10.1%* (4.7–21.1%)
Ceramic fractures	1305	1.03* (0.42–2.56)	5.0%* (2.1–12.0%)	115	1.63* (1.46–1.82)	7.8%* (7.0–8.7%)
Ceramic chipping	781	1.79* (0.81–3.96)	8.6%* (4.0–18.0%)	141	1.45* (0.70–3.01)	7.0%* (3.5–14.0%)
Loss of retention	955	0.42* (0.16–1.09)	2.1%* (0.8–5.3%)	106	0.51* (0.23–1.12)	2.5%* (1.1–5.4%)

RESULTS

1. Zirconia exhibits **superior mechanical properties, biocompatibility, esthetics** compared to PFM prostheses.
2. Limited long-term data is available for long-span FDPs, but existing evidence suggests almost **similar 10-year survival rates** for both zirconia and PFM with **higher technical complication rates for Zirconia** especially for veneering ceramic fractures.
3. **Metal-ceramic FDPs have been the gold standard** for posterior restorations due to its strength but **lack aesthetic characteristics** and can be **challenging in areas with insufficient space.**
4. **Increase in span length of zirconia framework** may **decrease** its marginal and internal fit.
5. **Regardless of the material, long span prostheses** (5 units or more) can be associated with a **higher technical complication rate** compared to short span prostheses.
6. **The size of the connector** can strongly influence the longevity of the restoration.
7. **More tooth reduction is required with PFM** compared to zirconia.

CONCLUSION

Zirconia and PFM prostheses exhibit similar 10-year survival rates. Zirconia emerges as a promising alternative with superior mechanical properties, biocompatibility and aesthetics.

Technical complication rates such as veneering ceramic fractures are **higher with zirconia-ceramic FDPs**.

Increase in span length of zirconia framework may **increase** the technical complications.

Connector size and framework span length must be considered for optimizing the longevity of zirconia restorations