Evidence Based Dentistry Rounds

Dental Materials

Group 8A

Team 5

Date 11/18

Rounds Team

- **Group Leader: Dr. Toburen**
- **Specialty Leader: Dr. Berzins**
- **Project Team Leader: D4 Steven Fegan**
- **Project Team Participants: D1 Matt Beck; D2 Ethan Farr; D3 Stephanie Drake**

Patient

- 54 yo Caucasian male
- I’m missing one of my front teeth and I “look like a hillbilly”
- Pt was in an accident that led to many of his teeth and restorations chipping and fracturing
- Pt has been without tooth #7 for four years and is ready to get it fixed
- Pt has high dental IQ and came in asking for a bridge

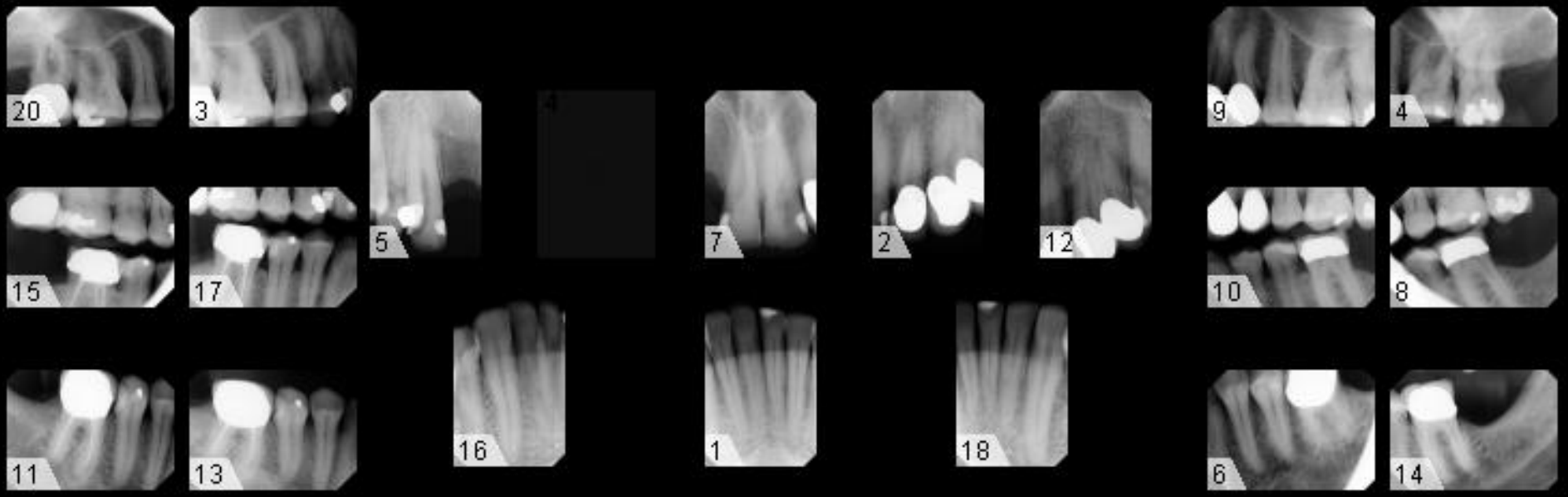
Medical History

- Depression
- Seasonal allergies
- Sleep apnea
  - Uses CPAP machine
- Previous tobacco user
- Multiple joint replacements
  - Shattered pelvis, hip replacement, rotator cuff
  - Due to an accident
  - Medical consult: no premedication required

Dental History

- History of extractions for lower second molars as well as tooth #7
- Previous dental treatment with fillings and PFM crowns
- Incisal wear and chipping of teeth
- Porcelain chipping on multiple PFM crowns
- Abfraction lesions

Radiographs



Radiographic Findings

- RCT #3 and #30
- Multiple fillings and PFM crowns

Clinical Findings

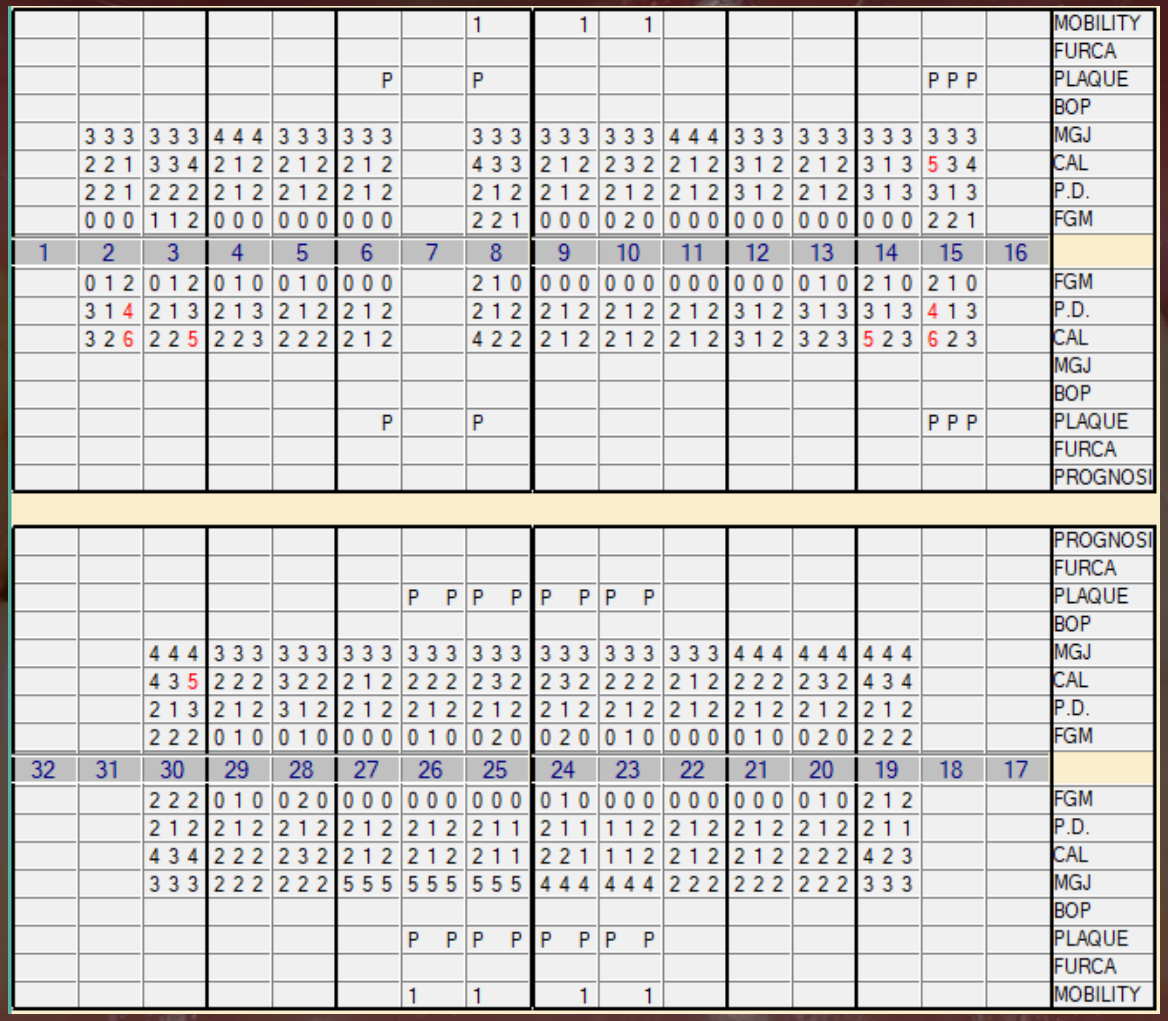
- PFM crowns: #2, #10, #11, #12, #19, #30
- Composite: #3 DO, #6 MLD, #8 DL, #9 DL, #14 M, #20DO, #21 O, #24 IL, #29 DO
- Amalgam: #5 MO, #14 O, #15 BOL

Clinical Findings

- Incisal edge wear: #6, #8, #9
- Porcelain chipping: #7, #19, #30
- Abfraction lesion: #6, #8, #9

Specific Findings

- Missing tooth #7
- Chipping, abfraction, and wear on anterior teeth,
- Class III end-to-end occlusion
- Mis-matched shade on existing PFM crowns
- Chipping porcelain on PFM Crown #10



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Periodontal Diagnosis: Stage 2 Grade B periodontal disease due to clinical attachment loss and age of patient

Problem List

- Missing teeth
- Chipping porcelain
- Incisal wear and chipping
- Abfraction lesions
- Class III end-to-end

D1 Basic Science

Matt Beck

Porcelain-Fused-to-Metal (PFM)

- Have been the ”standard” of full coverage crowns for decades
- Contain an alloy metal core with a layer of porcelain wrapped around it

Zirconia

- Zirconium dioxide (ZrO_2)
- Powdered form of zirconium
- Member of the titanium group
- Two types of Zirconia:
  - **Solid (Monolithic) Zirconia**
  - **High Translucent Zirconia**

Lithium Disilicate

- Glass ceramic
- Extremely popular today with the use of computer aided design/computer aided manufacturing (CAD/CAM) technology in dental practice

Porcelain-Fused-to-Metal (PFM)	Zirconia	Lithium Disilicate
Advantages: • Great for bridges • Great strength for posterior restorations • Longevity • Cheaper than newer crown materials	Advantages: • Biocompatible • Resistant to fracture • Strongest crown type • Highly esthetic • Variability (Monolithic and High translucency) • CAD/CAM Technology	Advantages: • Very good strength • Highly esthetic • Greater translucency • CAD/CAM Technology
Disadvantages: • Tendency to crack and break between opposing tooth and metal layer • Poor esthetics	Disadvantages: • Toughness of material may lead to friction against opposing teeth • Not ideal when esthetic considerations are very high	Disadvantages: • Tend to fail in the posterior region • Abrasion of opposing enamel

Cho, Aleah, et al. “Comparing Three Ceramic Materials for Digital Dentistry.” *Decisions in Dentistry*, 6 Mar. 2020, decisionsindentistry.com/article/comparing-three-ceramic-materials-for-digital-dentistry/.

Hong, Kari Ann. “Emax Lithium Disilicate Crowns.” *Thousand Oaks Family Dentistry | Thousand Oaks Dentist*, Thousand Oaks Family Dentistry | Thousand Oaks Dentist, 29 May 2014, www.thousandoaksfamilydentistry.com/blog/2014/5/28/emax-lithium-disilicate-crowns.

“What Is a Porcelain Fused to Metal Crown?” *Fox Valley Dental*, 9 Jan. 2020, foxvalleydental.com/what-is-a-porcelain-fused-to-metal-crown/.

“Zirconia Crown: Advantages and Disadvantages: Shanti Dental Clinic.” *Shanti Dentals*, shantidentals.com/zirconia-crown-advantages-and-disadvantages/.

D2 Pathology

Ethan Farr

What is the etiology of incisal wear, incisal chipping, porcelain chipping, and abfraction lesions?

- Incisal Wear
  - Opposing teeth(Tooth-tooth)
  - Tooth-Restoration
  - Parafunctional Habits
    - Bruxism and Clenching
  - Class III Malocclusion
    - End-to-End Contact
  - Extra-oral objects
- Incisal Chipping
  - Biting hard Substances
  - Car Accidents and Falls
  - Contact Sports
  - Bruxism
  - Beer Bottles

Hanif A, Rashid H, Nasim M. Tooth surface loss revisited: Classification, etiology, and management. J Res Dent [serial online] 2015 [cited 2020 Nov 10];3:37-43. Available from: http://www.jresdent.org/text.asp?2015/3/2/37/156643

Hmaidouch, R., & Weigl, P. (2013). Tooth wear against ceramic crowns in posterior region: a systematic literature review. *International journal of oral science*, *5*(4), 183–190. https://doi.org/10.1038/ijos.2013.73

Miura S. et al. (2015) Clinical Chipping of Zirconia All-Ceramic Restorations. In: Sasaki K., Suzuki O., Takahashi N. (eds) Interface Oral Health Science 2014. Springer, Tokyo. https://doi.org/10.1007/978-4-431-55192-8_27

Photos: Benson. Alignment of the Dentition. Dental Anatomy and Occlusion Slide show. 2020

- Chipping Porcelain
  - Porcelain fracture rate of 0.9-29.1%
  - Traumatic contact
  - Large temperature gradient during cooling
  - Non-uniform thickness
- Abfraction Lesions
  - Combination of abrasion and occlusal Stresses
  - Tooth Flexure
  - Wedge-shaped defects near CEJ

Photos:Nascimento M, Dilbone D, Pereira P, Duarte W, Geraldeli S, Delgado A. Abfraction lesions: etiology, diagnosis, and treatment options. *Clin Cosmet Investig Dent*. 2016;8:79-87
https://doi.org/10.2147/CCIDE.S63465
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Hanif A, Rashid H, Nasim M. Tooth surface loss revisited: Classification, etiology, and management. J Res Dent [serial online] 2015 [cited 2020 Nov 10];3:37-43. Available from: http://www.jresdent.org/text.asp?2015/3/2/37/156643
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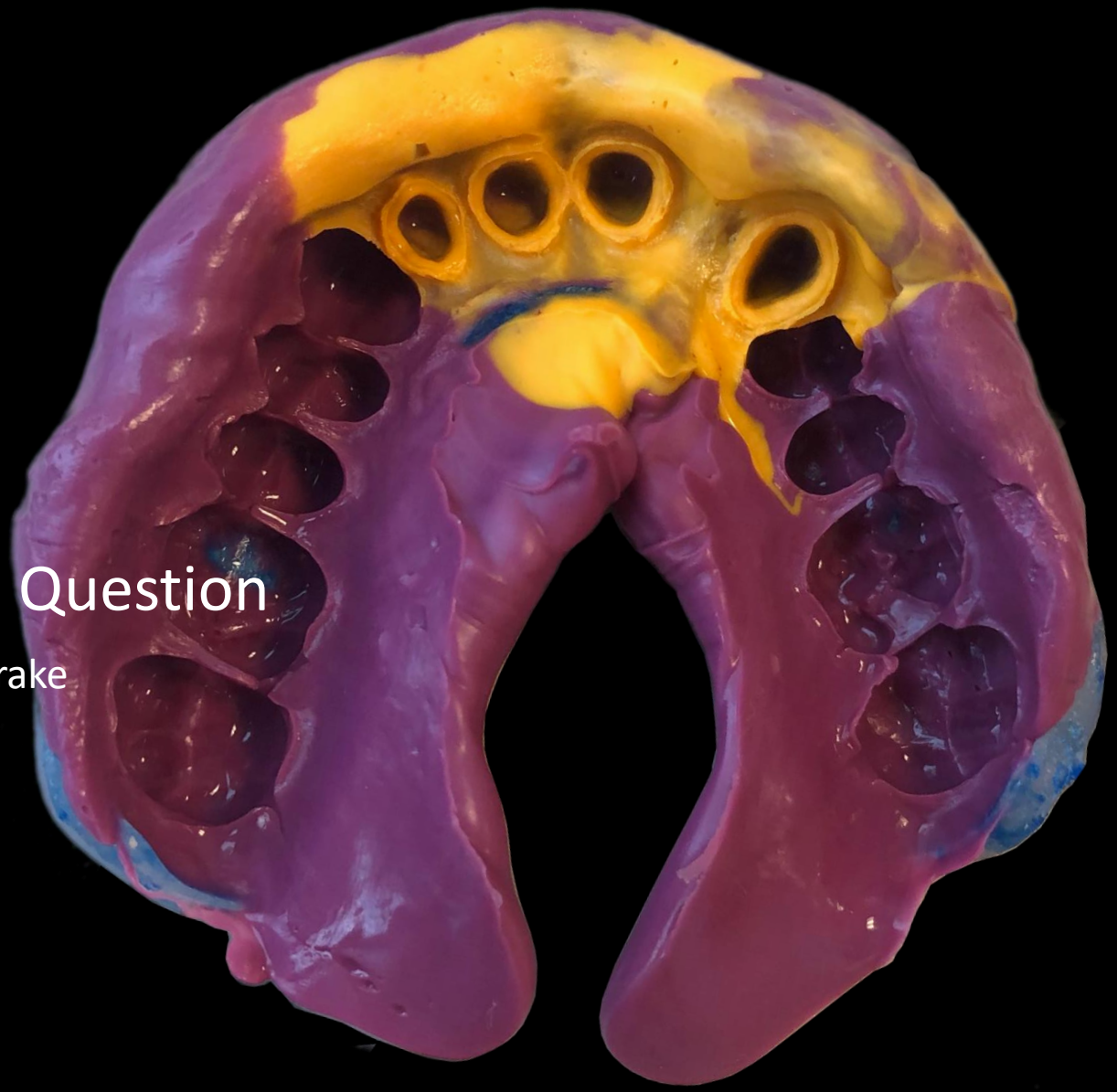
Miura S. et al. (2015) Clinical Chipping of Zirconia All-Ceramic Restorations. In: Sasaki K., Suzuki O., Takahashi N. (eds) Interface Oral Health Science 2014. Springer, Tokyo. https://doi.org/10.1007/978-4-431-55192-8_27



D3 PICO Question

Stephanie Drake

D3 PICO

- **Clinical Question:** Which dental material has the best clinical outcome for patients needing an anterior bridge?

PICO Format

P: Patients needing an anterior bridge
I: Zirconia
C: PFM or Lithium Disilicate
O: Better clinical results

PICO Formatted Question

- In patients needing an anterior bridge, does using Zirconia, PFM, or Lithium Disilicate lead to better clinical results?

Clinical Bottom Line

- Metal-ceramic FPDs have higher survival rates than all types of all-ceramic FPDs

PFM >> Zirconia > Lithium Disilicate

Search Background

- **Date of Search:** 11/09/2020
- **Database Used:** NCBI PubMed
- **Search Strategy/Keywords:** Ceramics, Dental Restoration Failure, Fixed Partial Denture, Metal Ceramic

Search Background

- **MESH terms used:** Ceramics, Dental Restoration Failure, Denture Partial Fixed, Humans, Metal Ceramic Alloys

Article 1 Citation, Introduction

- **Citation:** Pjetursson BE, Sailer I, Makarov NA, Zwahlen M, Thoma DS. 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. Dent Mater. 2015 Jun;31(6):624-39. doi: 10.1016/j.dental.2015.02.013. Epub 2015 Apr 30. Erratum in: Dent Mater. 2017 Jan;33(1):e48-e51. PMID: 25935732.

- **Study Design:** Systemic Review

- **Study Need/Purpose:** Assess 5-year survival of metal-ceramic and all-ceramic tooth-supported fixed dental prostheses (FDPs) and describes the incidence of biological, technical and esthetic complications

Article 1 Synopsis

- **Method:** Clinical studies focusing on tooth-supported FPDs with a mean follow-up of at least 3 years were searched on PubMed, CENTRAL, with 10 studies hand included from a previous systemic review. The robust Poisson's regression model was used to analyze survival and complication rates to obtain summary estimates of 5-year proportions

- **Results:**
  - Metal-ceramic FPD survival 94.4%
  - Zirconia FPD survival 90.4%
  - Lithium Disilicate FPD survival 89.1%

Article 1 Synopsis

- **Main Complications:**
  - Zirconia- Ceramic fractures & loss of retention
  - Lithium Disilicate- Framework fracture

- **Conclusions:** “Survival rates of all types of all-ceramic FDPs were lower than those reported for metal-ceramic FDPs”

Article 1 Selection

- Directly addresses PICO comparison between Zirconia, PFM, and Lithium Disilicate materials
- Systemic review with high level of evidence

- **Implication:** For our patient, a metal-ceramic bridge (PFM) would have the highest survival rate

Article 2 Citation, Introduction

- **Citation:** Sailer I, Pjetursson BE, Zwahlen M, Hämmerle CH. A systematic review of the survival and complication rates of all-ceramic and metal-ceramic reconstructions after an observation period of at least 3 years. Part II: Fixed dental prostheses. Clin Oral Implants Res. 2007 Jun;18 Suppl 3:86-96. doi: 10.1111/j.1600-0501.2007.01468.x. Erratum in: Clin Oral Implants Res. 2008 Mar;19(3):326-8. PMID: 17594373.

- **Study Design:** Systemic Review

- **Study Need/Purpose:** Assess the 5-year survival rates and incidences of complications of all-ceramic fixed dental prostheses (FDPs) compared with those of metal-ceramic FDPs

Article 2 Synopsis

- **Method:** Prospective and retrospective cohort studies on all-ceramic and metal-ceramic reconstructions with a mean follow-up time of at least 3 years were searched on MEDLINE and Dental Global Publication Research System along with manual searches. Patients must have been examined clinically at the follow-up visit.
  "Assessment of the identified studies and data abstraction was performed independently by three reviewers. Failure rates were analyzed using standard and random-effects Poisson regression models to obtain summary estimates of 5-year survival proportions"

Article 2 Synopsis

- **Results:**
  - Metal-ceramic FPD survival 94.4%
  - All-ceramic FPD survival 88.6%
    - Does not differentiate between Zirconia and Lithium Disilicate

- **Main Complications:**
  - Material fracture
    - Metal-ceramic: between 1.6% and 2.9%
    - Lithium disilicate: between 6.5% and 13.6%
  - Biological and technical complications
    - Zirconia

Article 2 Synopsis

- **Conclusions:** ”The failure rate of all-ceramic FDPs after 5 years was 11.4%. The corresponding figure for metal–ceramic FDPs was 5.6%, resulting in a 2.11-fold higher failure of all-ceramic FDPs”
- If all ceramic restorations must be used, Zirconia should be used rather than Lithium Disilicate

Article 2 Selection

- Same as Article 1
- Directly addresses PICO comparison between Zirconia, PFM, and Lithium Disilicate materials
- Systemic review with high level of evidence

- **Implication:** For our patient, a metal-ceramic bridge (PFM) would have the highest survival rate

Levels of Evidence

☐ **1a** – Clinical Practice Guideline, Meta-Analysis, Systematic Review of Randomized Control Trials (RCTs)

☐ **1b** – Individual RCT

☒ **2a** – Systematic Review of Cohort Studies

☐ **2b** – Individual Cohort Study

☐ **3** – Cross-sectional Studies, Ecologic Studies, "Outcomes" Research

☐ **4a** – Systematic Review of Case Control Studies

☐ **4b** – Individual Case Control Study

☐ **5** – Case Series, Case Reports

☐ **6** – Expert Opinion without explicit critical appraisal, Narrative Review

☐ **7** – Animal Research

☐ **8** – In Vitro Research

Strength of Recommendation Taxonomy (SORT)

☒	**A** – Consistent, good quality patient oriented evidence
☐	**B** – Inconsistent or limited quality patient oriented evidence
☐	**C** – Consensus, disease oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening

Conclusions: D3

Research conclusion: Both systemic reviews show that metal-ceramic (PFM) FPDs have a significantly higher 5-year survival rate when compared to both zirconia and lithium disilicate FPDs. If an all-ceramic FPD must be used, zirconia shows a higher survival rate than lithium disilicate

PFM >> Zirconia > Lithium Disilicate

Conclusions: D4

- Based on the evidence above and the patient presentation, we recommended layered zirconia restorations for all prosthesis.

Discussion Questions

Discussion Questions

THANK YOU