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

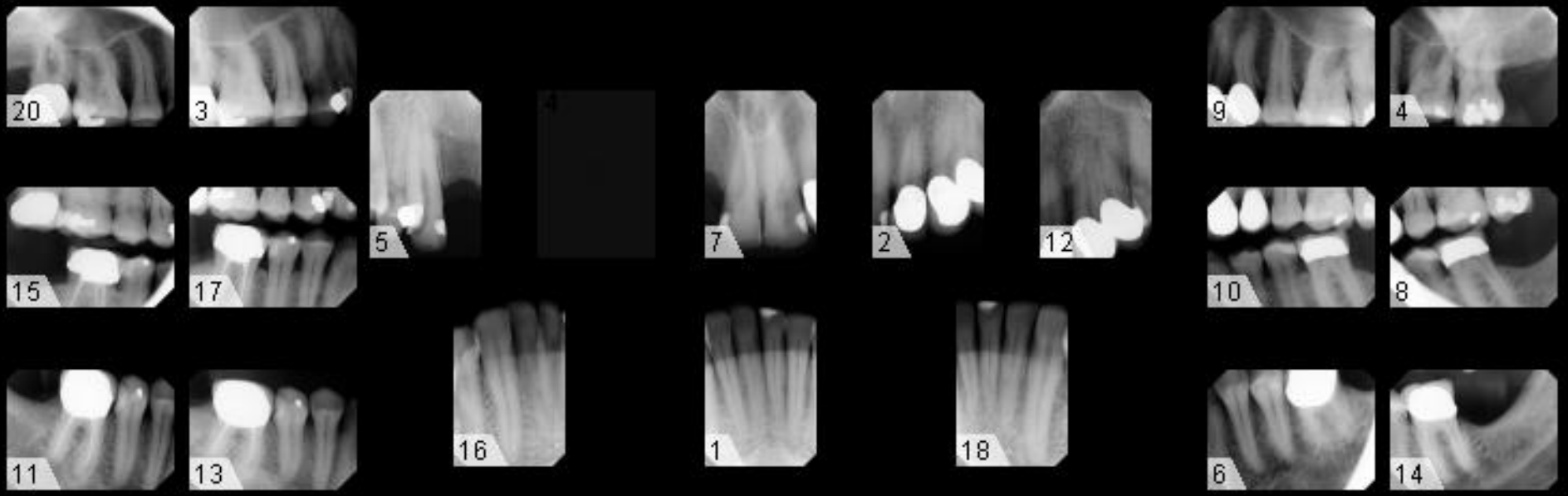
Medical History

- 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

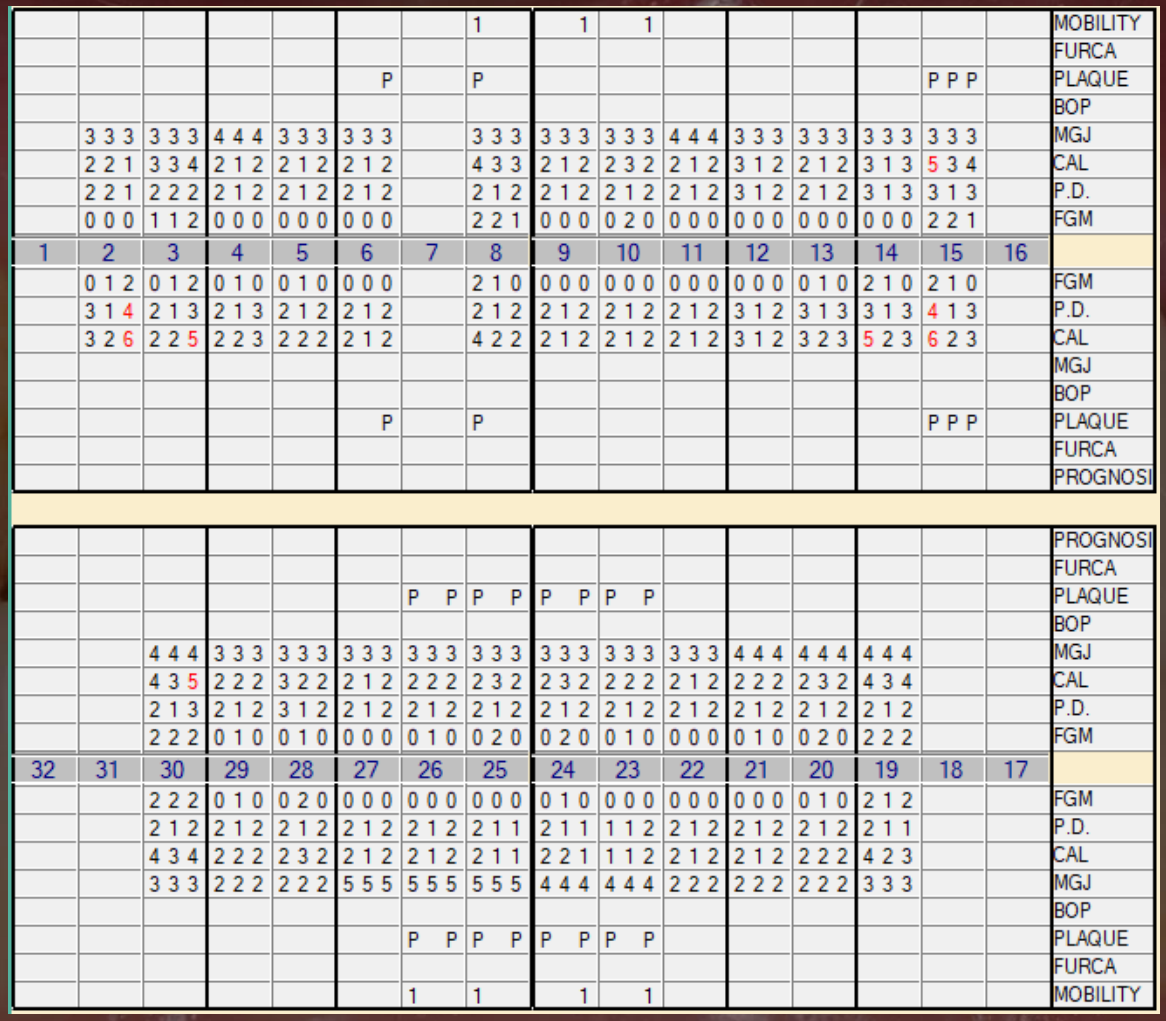
- PFM crowns: #2, #10, #11, #12, #19, #30
- Composite: #3 DO, #6 MLD, #8 DL, #9 DL, #14 M, #20DO, #21 O, #24 IL, #29 DO
- Amalgam: #5 MO, #14 O, #15 BOL

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
Mutlu Özcan[1], Cláudia Ângela Maziero Volpato[2] University of Zurich, Dental Materials Unit, Center for Dental and Oral Medicine, Clinic for Fixed and Removable Prosthodontics, and Dental Materials Science, Zurich, Switzerland

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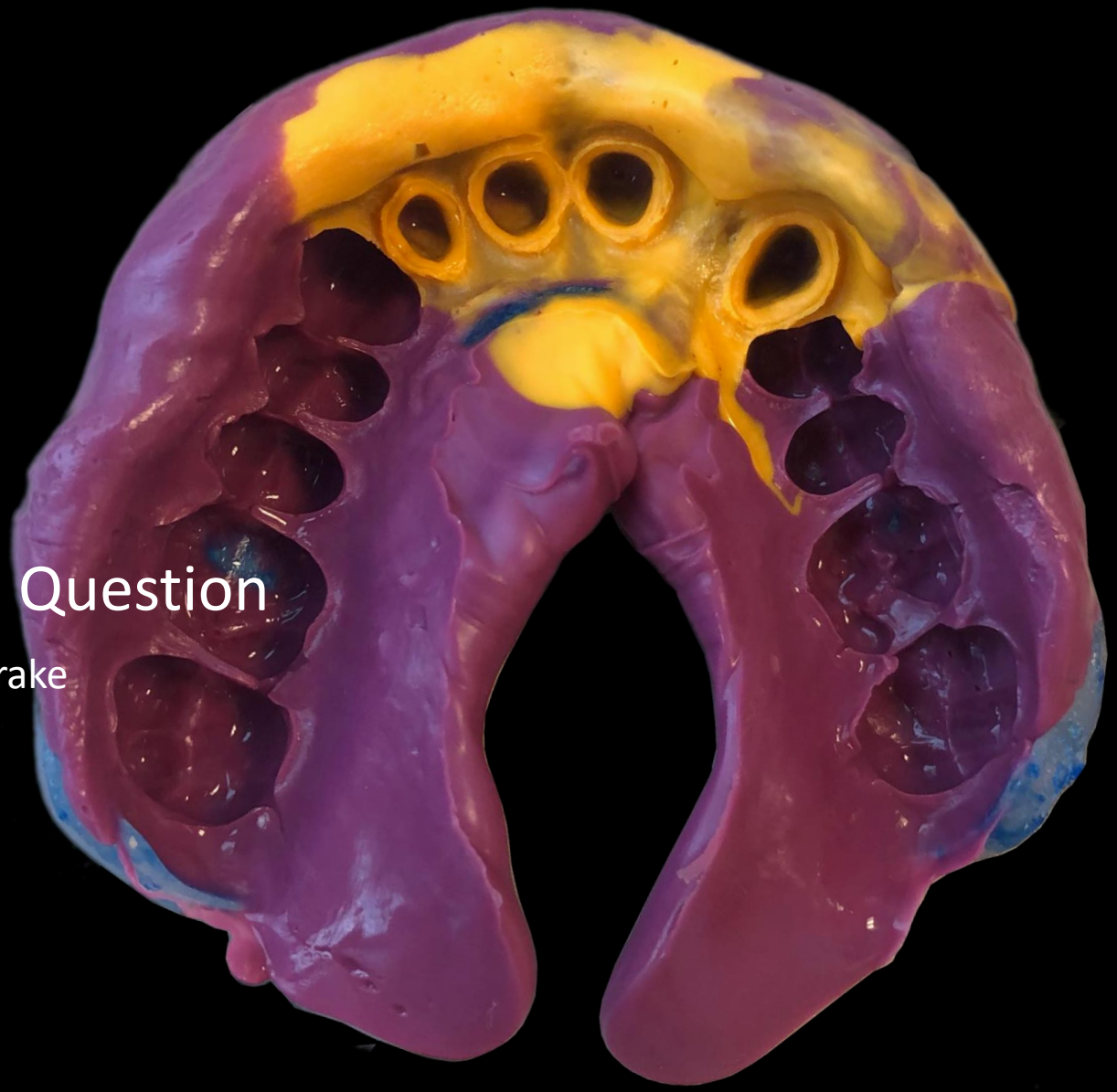
Miura S. et al. (2015) Clinical Chipping of Zirconia All-Ceramic Restorations. In: Sasaki K., Suzuki O., Takahashi N. (eds) Interface Oral Health Science 2014. Springer, Tokyo. https://doi.org/10.1007/978-4-431-55192-8_27



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

THANK YOU