# Selecting the Ideal Crown Material for two posterior teeth

**Evidence Based Dentistry**

**Prosthodontics**

Fall Rounds 2020

5A-5
Vishy Singh, Alex Wedige, Cameron Young, Amanda Toy
11/11/20

# Rounds Team

- **Group Leader: Dr. Dix**
- **Specialty Leader: Dr. Keesler**
- **Project Team Leader: Vishy Singh**
- **Project Team Participants: D1: Amanda Toy; D2: Cameron Young; D3: Alex Wedige**

# Patient

- 67 y.o Caucasian female
- CC: "I want my bite back!"
- Pt was a former smoker who quit over 10 years ago
- Has had a fair amount of dental work done over the last 5 years at MUSoD

# Medical History

- Current & past:
  - Conditions: GERD, Fibromyalgia

  - Medications:

| | |
|---|---|
| cholecalciferol (vitamin D3) | 1,000 unit/spray |
| Culturelle (lactobacillus rhamnosus gg) | 10 billion cell |
| multivitamin | capsule |
| Excedrin Migraine (aspirin-acetaminophen-caffeine) | 250-250-65 mg |
| ProAir RespiClick (albuterol sulfate) | 90 mcg/actuation |
| ketoconazole | 2% |
| B-complex with vitamin C | tablet |
| valacyclovir | 500 mg |
| Lyrica (pregabalin) | 200 mg |
| duloxetine | 60 mg |
| omeprazole | 40 mg |
| ibuprofen | 200 mg |

  - Treatment considerations: Pt cannot sit for long appointments and prefers afternoons

# Dental History

- Pt since 2016
- Pt has drastically improved her oral hygiene
- Hx of extractions and RCT
- RCT #5 and #14 done in August
- Had a RPD made at MUSoD in 2017 that does not fit due to extractions of abutment teeth in 2018

# Radiographic Findings

- #5 and #14 are endo treated with core build-ups
- #14 will oppose #19 which is a FCC
- #5 will oppose mandibular RPD

# Clinical Findings

- RPD will be Class III mod 1
- Generalized recession with shallow pockets

# Specific Findings

- #5 will oppose denture teeth of lower partial
- #14 will oppose #30 which is a FCC survey crown

# Periodontal Charting 8/10/18

**Maxillary (teeth 1–16)**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAQUE (F) | | | | | P  P | | P | | P | P | | P | P | | | |
| MGJ | | 5 5 5 | 5 5 5 | 5 5 5 | 3 3 3 | 4 4 4 | 4 4 4 | 6 6 6 | 6 6 6 | 5 5 5 | 5 5 5 | 5 5 5 | 5 5 5 | 5 5 5 | | |
| CAL | | 4 3 4 | 5 3 4 | 4 4 4 | 4 4 4 | 4 2 4 | 4 2 4 | 4 3 4 | 4 3 4 | 4 3 4 | 4 3 4 | 4 3 4 | 4 2 4 | 4 3 3 | | |
| P.D. | | 3 2 3 | 4 2 3 | 3 2 3 | 3 2 3 | 3 1 3 | 3 1 3 | 3 2 3 | 3 2 3 | 3 2 3 | 3 2 3 | 3 1 3 | 3 1 3 | 3 2 2 | | |
| FGM | | 1 1 1 | 1 1 1 | 1 2 1 | 1 2 1 | 1 1 1 | 1 1 1 | 1 1 1 | 1 1 1 | 1 1 1 | 1 1 1 | 1 2 1 | 1 1 1 | 1 1 1 | | |
| FGM | | 1 1 1 | 1 2 1 | 1 1 1 | 1 1 1 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 1 1 1 | 1 1 1 | 3 3 1 | | |
| P.D. | | 3 2 3 | 3 2 3 | 3 2 4 | 3 1 2 | 2 2 4 | 2 1 3 | 3 2 3 | 3 2 3 | 2 1 2 | 2 1 3 | 3 2 3 | 3 2 3 | 2 2 2 | | |
| CAL | | 4 3 4 | 4 4 4 | 4 3 5 | 4 2 3 | 2 2 4 | 2 1 3 | 3 2 3 | 3 2 3 | 2 1 2 | 2 1 3 | 4 3 4 | 4 3 4 | 5 5 3 | | |
| PLAQUE (L) | | | P | | | P | P | P | P | | | P | P | | | |

**Mandibular (teeth 32–17)**

| | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAQUE (L) | | | | | P  P | P | | | P | P  P | | P | | | | |
| MGJ | | 6 6 6 | | | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | | 4 4 4 | 4 4 4 | |
| CAL | | 4 4 4 | | | 5 5 3 | 3 1 3 | 2 3 2 | 2 3 2 | 2 3 2 | 2 3 2 | 2 3 2 | 2 3 2 | | 4 3 5 | 5 3 5 | |
| P.D. | | 3 3 3 | | | 3 3 3 | 3 1 3 | 2 2 2 | 2 2 2 | 2 2 2 | 2 2 2 | 2 2 2 | 2 2 2 | | 3 2 4 | 4 2 4 | |
| FGM | | 1 1 1 | | | 2 2 0 | 0 0 0 | 0 1 0 | 0 1 0 | 0 1 0 | 0 1 0 | 0 1 0 | 0 1 0 | | 1 1 1 | 1 1 1 | |
| FGM | | 1 1 1 | | | 2 3 1 | 1 1 1 | 1 2 1 | 1 2 1 | 1 2 1 | 1 1 1 | 1 1 1 | 1 3 1 | | 1 2 1 | 1 1 1 | |
| P.D. | | 2 2 3 | | | 3 1 3 | 3 1 3 | 3 1 3 | 3 1 2 | 3 1 3 | 3 1 3 | 2 2 2 | 3 2 3 | | 4 2 3 | 3 2 3 | |
| CAL | | 3 3 4 | | | 5 4 4 | 4 2 4 | 4 3 4 | 4 3 3 | 4 3 4 | 4 2 4 | 3 3 3 | 4 5 4 | | 5 4 4 | 4 3 4 | |
| MGJ | | 3 3 3 | | | 3 3 3 | 3 3 3 | 3 3 3 | 2 2 2 | 2 2 2 | 3 3 3 | 2 2 2 | 1 1 1 | | 2 2 2 | 2 2 2 | |
| PLAQUE (F) | | P | | | P | | P | P | | | P | P | | | | |

Right-margin row labels (top section): MOBILITY, FURCA, PLAQUE, BOP, MGJ, CAL, P.D., FGM, (teeth), FGM, P.D., CAL, MGJ, BOP, PLAQUE, FURCA, PROGNOSIS

Right-margin row labels (bottom section): PROGNOSIS, FURCA, PLAQUE, BOP, MGJ, CAL, P.D., FGM, (teeth), FGM, P.D., CAL, MGJ, BOP, PLAQUE, FURCA, MOBILITY

# Periodontal Charting 8/26/20

**Maxillary — Facial**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MOBILITY | | | | | | | | | | | | | | | | | |
| FURCA | | | | | | | | | | | | | | | | | |
| PLAQUE | | P | | | | | P | | P | | | | | | | | |
| BOP | | | | | | | | | | | | | | | | | |
| MGJ | | 5 5 5 | 5 5 5 | 6 6 6 | 4 4 4 | 5 5 5 | 5 5 5 | 5 5 5 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | 4 4 4 | | | |
| CAL | | 3 3 3 | 5 4 5 | 2 2 3 | 3 3 3 | 2 1 2 | 2 2 2 | 2 1 2 | 3 1 2 | 2 1 3 | 3 1 2 | 3 2 2 | 2 1 2 | 3 1 3 | | | |
| P.D. | | 2 2 2 | 2 1 2 | 2 1 3 | 3 1 2 | 2 1 2 | 2 1 2 | 2 1 2 | 3 1 2 | 2 1 3 | 3 1 2 | 3 1 2 | 2 1 2 | 3 1 3 | | | |
| FGM | | 1 1 1 | 3 3 3 | 0 1 0 | 0 2 1 | 0 0 0 | 0 1 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 1 0 | 0 0 0 | 0 0 0 | | | |

**Maxillary — Palatal**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FGM | | 1 0 0 | 2 2 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 1 1 | 0 1 2 | | | |
| P.D. | | 2 1 3 | 3 1 3 | 3 1 2 | 2 1 2 | 2 1 3 | 3 1 2 | 2 1 2 | 3 1 2 | 2 1 2 | 1 1 2 | 1 1 2 | 2 1 2 | 2 1 2 | | | |
| CAL | | 3 1 3 | 5 3 3 | 3 1 2 | 2 1 2 | 2 1 3 | 3 1 2 | 2 1 2 | 3 1 2 | 2 1 2 | 1 1 2 | 1 1 2 | 2 2 3 | 2 2 4 | | | |
| MGJ | | | | | | | | | | | | | | | | | |
| BOP | | | | | | | | | | | | | | | | | |
| PLAQUE | | P | | | | | | | | | | | | | | | |
| FURCA | | | | | | | | | | | | | | | | | |
| PROGNOSI | | | | | | | | | | | | | | | | | |

**Mandibular — Facial**

| | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROGNOSI | | | | | | | | | | | | | | | | | |
| FURCA | | | | | | | | | | | | | | | | | |
| PLAQUE | | | | | | | | | | | | | | | | P  P | |
| BOP | | | | | | | | | | | | | | B . | . B | | |
| MGJ | | 5 5 5 | | | | | 4 4 4 | 3 3 3 | 3 3 3 | 3 3 3 | 4 4 4 | 4 4 4 | | 5 5 5 | 5 5 5 | | |
| CAL | | 2 3 3 | | | | | 3 3 3 | 2 1 2 | 2 2 2 | 2 2 2 | 2 3 3 | 2 1 3 | | 2 1 3 | 1 2 2 | | |
| P.D. | | 2 2 3 | | | | | 2 2 2 | 2 1 2 | 2 1 2 | 2 1 2 | 2 1 3 | 2 1 3 | | 2 1 3 | 1 2 2 | | |
| FGM | | 0 1 0 | | | | | 1 1 1 | 0 0 0 | 0 1 0 | 0 1 0 | 0 2 0 | 0 0 0 | | 0 0 0 | 0 0 0 | | |

**Mandibular — Lingual**

| | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FGM | | 0 0 0 | | | | | 2 2 0 | 1 2 1 | 0 2 0 | 0 1 0 | 0 1 0 | 0 0 0 | | 0 0 0 | 1 1 0 | | |
| P.D. | | 3 2 2 | | | | | 1 2 1 | 2 1 2 | 1 1 1 | 2 1 2 | 2 1 2 | 2 1 2 | | 1 1 2 | 2 1 2 | | |
| CAL | | 3 2 2 | | | | | 3 4 1 | 3 3 3 | 1 3 1 | 2 2 2 | 2 2 2 | 2 1 2 | | 1 1 2 | 3 2 2 | | |
| MGJ | | 4 4 4 | | | | | 3 3 3 | 4 4 4 | 3 3 3 | 5 5 5 | 4 4 4 | 3 3 3 | | 4 4 4 | 4 4 4 | | |
| BOP | | | | | | | | | | | | B | | | | | |
| PLAQUE | | | | | | | | | | | | | | | | | |
| FURCA | | | | | | | | | | | | | | | | | |
| MOBILITY | | | | | | | | | | | | | | | | | |

# Diagnosis

- Pt has reduced biting/ chewing ability after having 26-28 ext and losing her lower partial
- RCT treated #5 and #14 require definitive restorations for protection

# Problem List

- RCT treated 5 and 14 require crowns
- Finish mandibular RPD

# D1 Basic Science

- **What is root canal treatment?**
  - Also known as endodontic treatment
  - Treatment for infected pulp of a tooth which results in elimination of infection and protects the tooth from future microbial invasion

- **Indications:**
  - Deep decay
  - Trauma
  - Fractured tooth

- **Advantages:**
  - Avoid extractions
  - Natural appearance
  - Normal biting force

# Root Canal Treatment

Decay

Gum

Infected pulp

Abscess

Dentin

Nerves, blood vessels

Bone
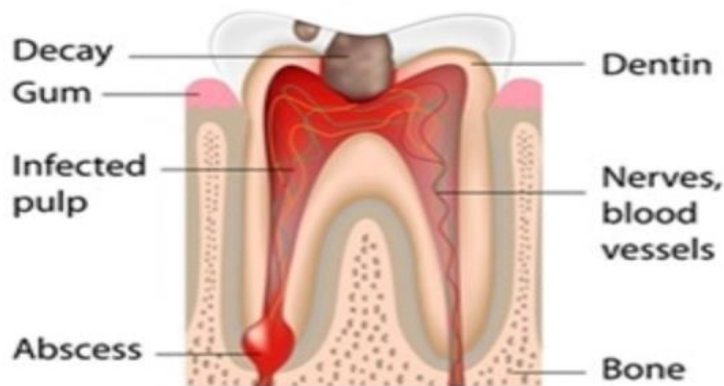
**Infected tooth**

Opening

**Opening made in tooth**

Endodontic file

**Infected tissue removed; Canals cleaned**

Plugger
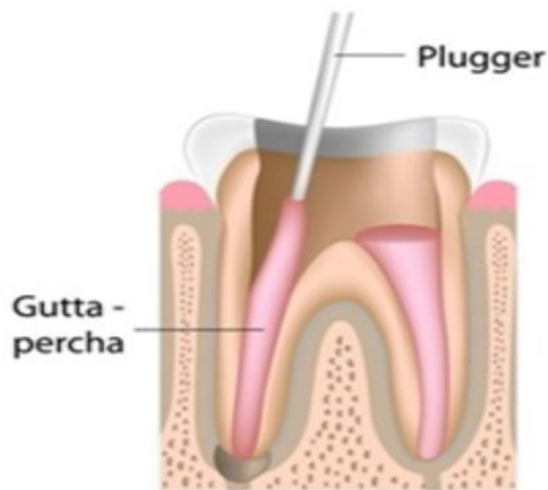
Gutta - percha

**Canals filled with a permanent material (gutta - percha)**

Filling

Post

**Opening sealed with filling. In some cases, a post is inserted for extra support**

Crown

**New crown cemented onto rebuilt tooth**

# D2 Pathology: What are the contributing factors for bruxism?

- **Bruxism can be defined as:**
  - *"a repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible"*

- **2 circadian manifestations:**
  - Sleep bruxism
  - Awake bruxism

- **Prevalence:**
  - Higher in females
  - Most common in younger children and decreases with age

- **Complex, controversial, and most likely multifactorial**

Bertazzo-Silveira, Eduardo, et al. "Association between Sleep Bruxism and Alcohol, Caffeine, Tobacco, and Drug Abuse." The Journal of the American Dental Association, vol. 147, no. 11, 2016.
Feu, Daniela, et al. "A Systematic Review of Etiological and Risk Factors Associated with Bruxism." Journal of Orthodontics, vol. 40, no. 2, 2013, pp. 163–171.

# D2 Pathology: What are the contributing factors for bruxism?

- **Current hypotheses that etiology of sleep bruxism involves central nervous system disturbances**
    - Alcohol, Nicotine, Caffeine, Antidepressant, Antipsychotics, Amphetamine use
    - Can be diagnosed/tracked using polysomnography

- **Awake bruxism is harder to diagnose and study**
    - Reliant on anecdotal reports and questionnaires from patient
    - Controversial but some studies suggest major contributory factors include increased stress and anxiety
    - Certain neurologic disorders increase susceptibility

- **Protective?**
    - Hypothesis that acid influx into esophagus (decreasing pH) during GER causes increase in rhythmic masticatory muscle activity (RMMA) which may act to prevent aspiration or mucosal injury from acidic secretions

Bertazzo-Silveira, Eduardo, et al. "Association between Sleep Bruxism and Alcohol, Caffeine, Tobacco, and Drug Abuse." The Journal of the American Dental Association, vol. 147, no. 11, 2016.
Feu, Daniela, et al. "A Systematic Review of Etiological and Risk Factors Associated with Bruxism." Journal of Orthodontics, vol. 40, no. 2, 2013, pp. 163–171.

# D3 PICO

- **Clinical Question: How does antagonist wear differ between all-ceramic and metal-ceramic crowns?**

# PICO Format

P: Patients with posterior crowns

I: All-ceramic crowns

C: Metal-ceramic crowns

O: Antagonist wear

# PICO Formatted Question

- In patients with posterior crowns, how does antagonist wear differ between all-ceramic and metal-ceramic crowns?

# Clinical Bottom Line

- **Antagonist tooth wear of all-ceramic crowns is comparable to metal-ceramic crowns in posterior single-tooth fixed prostheses.**

# Search Background

- **Date(s) of Search:** 11/01/20
- **Database(s) Used: PubMed**
- **Search Strategy/Keywords:** Antagonist wear, ceramic crowns, lithium disilicate, zirconium, porcelain, dental materials, metal-ceramic crowns

# Search Background

- **MESH terms used:**

  **Crowns, Dental Enamel, Tooth Wear, Zirconium, Lithium Disilicate, Dental Porcelain, Metal Ceramic Alloys, Surface Properties, Dental Materials**

# Article 1 Citation, Introduction

- Citation: 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

- Study Design: Systematic Review

- Study Purpose: Assess antagonist tooth wear in all-ceramic and metal ceramic crowns.

- Methods
  - A PubMed search for cohort studies on posterior tooth wear by ceramic crowns was performed.
  - Inclusion criteria consisted of use of human participants, analysis of ceramic crown antagonist wear, defined inclusion and exclusion criteria and materials and methods, and at least a 6-month follow-up period. 5 *in vivo* studies qualified.

# Article 1 Synopsis

- Results
    - Wear comparisons between all-ceramic and metal-ceramic crowns varied between studies depending on metal-ceramic occlusal material.
        - Antagonist wear ranked lowest to highest: PFM-metal occlusal surface, lithium disilicate, monolithic zirconia, PFM-porcelain occlusal surface.
    - Increased ceramic hardness did not directly correlate with increased wear.
    - Surface smoothness and uniformity of ceramics reduced antagonist wear.

- Conclusions
  - All-ceramic crowns produced clinically acceptable and comparable wear to metal-ceramic crowns.
  - Surface smoothness and resistance to deterioration relate more to antagonist wear than surface hardness.
  - Ceramic surface finishing, laboratory and/or chairside, is strongly recommended to reduce opposing tooth wear.
  - Uniformly designed future research on antagonist wear is vital to bolster research validity.

# Article 1 Synopsis

- Limitations
  - Small amount of studies analyzed
  - Nonuniform testing methods and study duration
  - Varying crown systems used between studies

# Article 1 Selection

- Reason for selection
  - Directly relates to PICO question
- Applicability to your patient
  - Directly applies to patient's current dental status and potential future treatment

# Article 1 Selection

- Implications
  - All-ceramic and metal-ceramic crowns are both clinically acceptable means of restoring a single posterior tooth in terms of antagonist wear.
  - Ceramic hardness alone does not dictate opposing tooth wear.
  - Proper fabrication and finishing of ceramics are important aspects of reducing antagonist wear.
  - Long-term, high-level research is needed to strengthen clinical applicability of antagonist wear research.

- Citation: Mundhe, K., Jain, V., Pruthi, G., & Shah, N. (2015). Clinical study to evaluate the wear of natural enamel antagonist to zirconia and metal ceramic crowns. *The Journal of Prosthetic Dentistry, 114*(3), 358–363. https://doi.org/10.1016/j.prosdent.2015.03.001

- Study Design: Individual Cohort study

- Study Purpose: Compare antagonist enamel wear between natural enamel, zirconia crowns, and metal-ceramic crowns after one year.

# Article 2 Synopsis

- Methods
  - Ten adult patients requiring two posterior tooth crowns received one monolithic zirconia crown and one metal-ceramic crown with a ceramic occlusal surface.
  - Enamel-enamel opposition was used as a baseline.
  - Resulting casts from initial cementation appointment and 1-year follow-up were compared using a 3D imaging software.

# Article 2 Synopsis

- Results
  - Enamel-enamel wear was significantly lower than both ceramic materials.
  - Monolithic zirconia antagonist tooth wear was significantly lower than metal-ceramic crowns.
  - Premolar wear was significantly less than molar wear for all groups.

# Article 2 Synopsis

- Conclusions
  - Significantly lower antagonist enamel wear occurred from natural teeth compared to both crown systems tested.
  - Zirconia crowns produced less enamel wear than metal-ceramic crowns with porcelain occlusal surfaces.
  - Premolar crown antagonist wear was significantly lower than molar crowns.

- Limitations
  - Small sample size
  - Relatively short observation period

# Article 2 Selection

- Reason for selection
  - Directly relates to PICO question
- Applicability to your patient
  - Directly applies to patient's current dental status and potential future dental treatment.
- Implications
  - Monolithic zirconia crowns may be preferable to feldspathic porcelain veneered metal-ceramic crowns with porcelain occlusal surfaces in posterior restorations as they cause less antagonist wear.

- Citation: Oh, W. S., Delong, R., & Anusavice, K. J. (2002). Factors affecting enamel and ceramic wear: a literature review. *The Journal of Prosthetic Dentistry, 87*(4), 451–459. https://doi.org/10.1067/mpr.2002.123851.

- Study Design: Narrative Review

- Study Purpose: Review features of ceramics that relate to antagonist wear from previous studies.

- Methods
  - A PubMed search for articles relating to "wear of enamel" and "ceramic" to identify peer-reviewed articles related to ceramic antagonist wear.

- Results
  - Fracture toughness and frictional coefficient values relate to amount of antagonist wear.
  - Material porosity and surface irregularity from fabrication and wear concentrate stress and increase antagonist wear.
  - Proper fabrication and surface finishing helps relieve wear.
  - Patient factors like poor pH balance, malocclusion, and parafunction can negatively effect ceramic surface composition and hence increase antagonist wear.

# Article 3 Synopsis

- Conclusion
  - Ceramic material properties, fabrication and handling methods, and patient factors directly affect antagonist wear.
  - Limitations
    - No defined exclusion or inclusion criteria
    - Low-level evidence reviewed

# Article 3 Selection

- Reason for selection
  - Directly relates to PICO question.

- Applicability to your patient
  - Directly applies to patient's current dental status and potential future treatment.

- Implications
  - Material properties, fabrication and finishing methods, and patient factors should be carefully considered and addressed when applicable when planning a ceramic fixed prosthesis.

☐ **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

- How will you advise your D4?

- When considering metal-ceramic and all-ceramic posterior crown materials as they relate to antagonist wear, I would advise the use of polished lithium disilicate, polished monolithic zirconia crowns or metal-ceramic crowns with a metal occlusal surface based on the aforementioned studies, patient factors, and specialist recommendations.

# Conclusions: D4

- Suggest the patient lean towards FCC or PFM for #14 because esthetics will be less of concern

- Suggest PFM with metal occlusal for #5 in order to maximize the life of mandibular RPD

- Keep up the good work with hygiene
  - RPDs are tricky – confirm proper hygiene understanding

# Discussion Questions

- Any questions?

# THANK YOU

46