Dental Materials

2A 9/30/2020

Rounds Team

Group Leader: Dr. Pelz

Specialty Leader: Dr. Berzins

D4: Emily Riesgraf

D3: Anja Amundson

D2: Jennifer St. Pierre

D1: Lia Grandinetti

Patient

Age: 73yo

Gender: Female

Ethnicity: White

Chief complaint: “I want a pretty smile”

** patient is very concerned about esthetics

Medical history

Conditions: L hip replacement 2007 , HTN, arthritis

Medications: Losartan, Aleve, Lipitor, Glucosamine/Chondroitin, Prilosec

Medical consults: premed for hip- not needed

Treatment considerations: take BP at the beginning of appts

Dental history

Extractions: 3, 6, 13, 14,15, 19, 30

RCT: 2, 4, 5, 18, 20, 28, 29

Bridge: 29-30 (cantilever)

OH: Brush 1/day, Floss 1/week

Radiographs


SN

Radiographic Findings

- Layered resin restorations M and D
- Open margin M (?)
- DI chip

Clinical Findings

- DI chip
- M and D recurrent caries
- Rough/uneven facial surface
- Non consistent color matching/staining

Specific Findings

#8 several layers of resin restorations

#8 DI chip

#8 recurrent caries M and D

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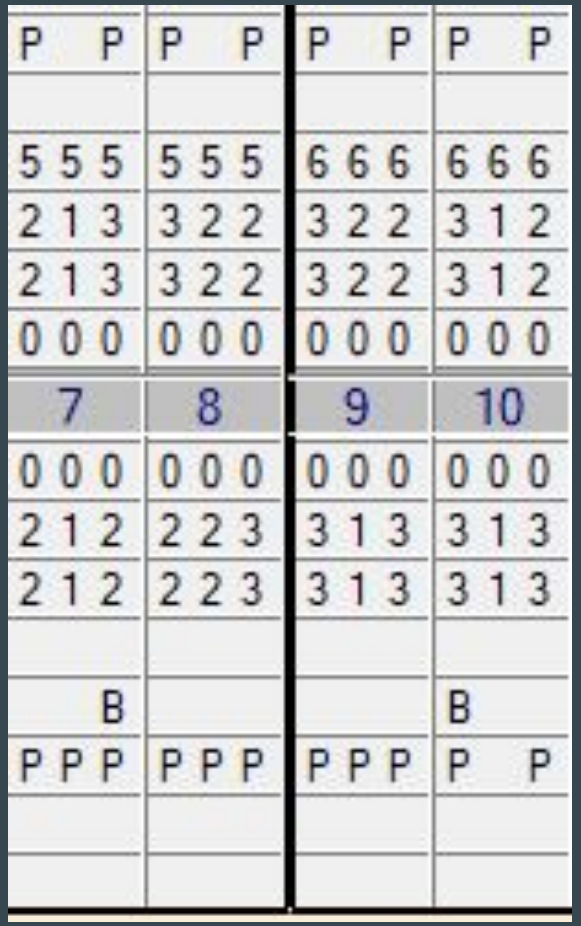
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Diagnosis

Recurrent caries #8M and D

#8 DI chip

Problem List

Recurrent caries

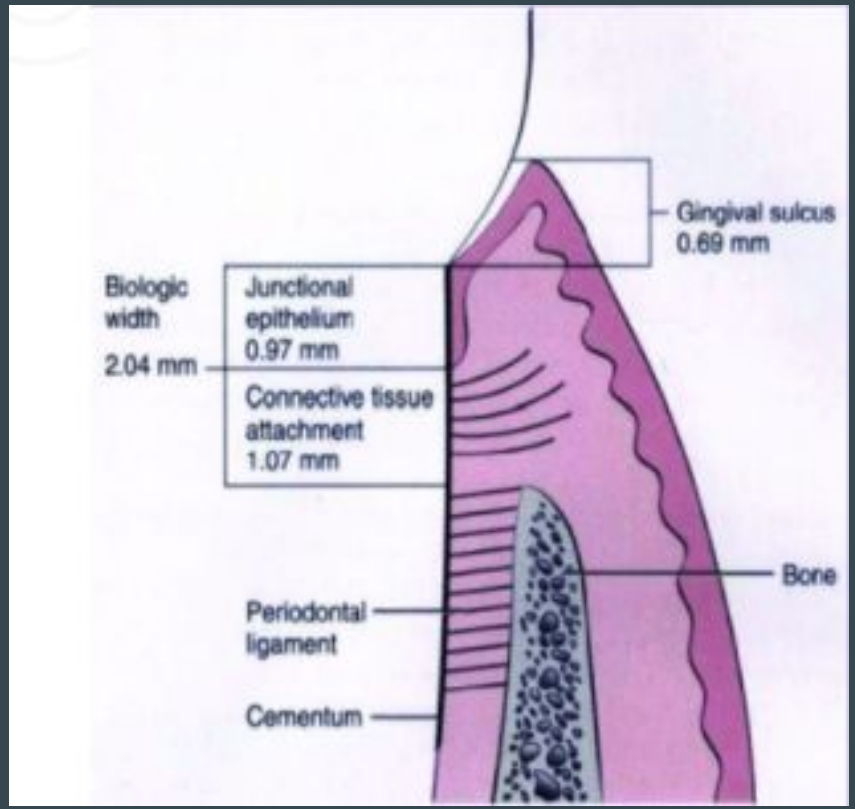
Marginal breakdown of restorations/unsupported resin

Esthetic concerns- shade match/chip/roughness

Why do we need to consider biological width when placing subgingival margins?

- Subgingival restorations are restorations with margins that reside apical to the free gingival margin such as:
  - class 2 restorations
  - class 5 restorations
  - crowns

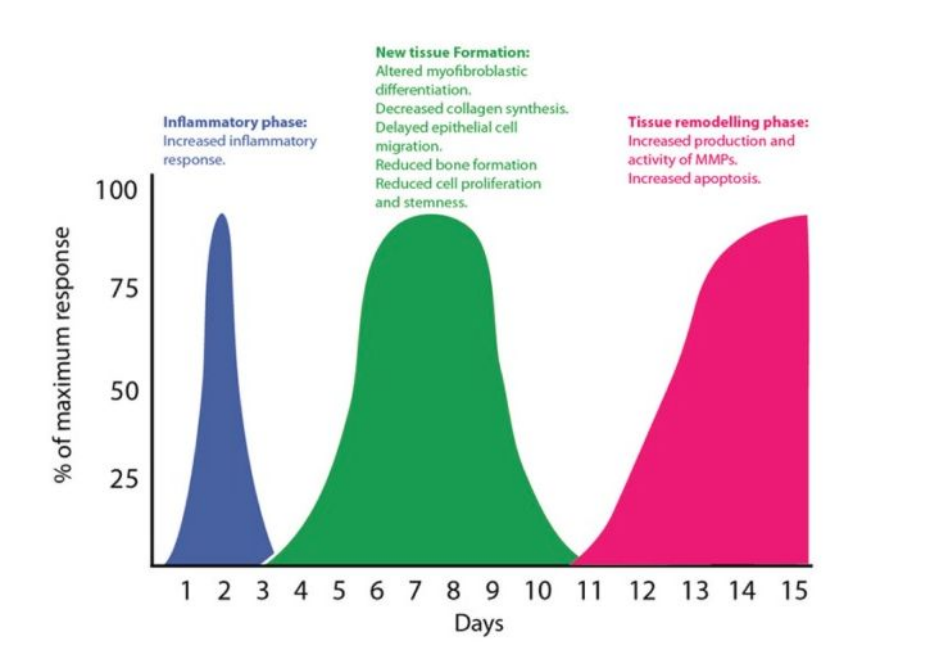
- Biological Width - the sections of soft tissue which are attached to the tooth, coronal to the crest of the alveolar bone



- Typically gingival healing occurs in three phase:
  - Inflammation
  - New tissue formation
  - Tissue remodeling

- When biological width is impinged on, prolonged inflammation occurs at the site of the restoration

- Chronic inflammation leads to gingival recession, periodontitis and alveolar bone loss



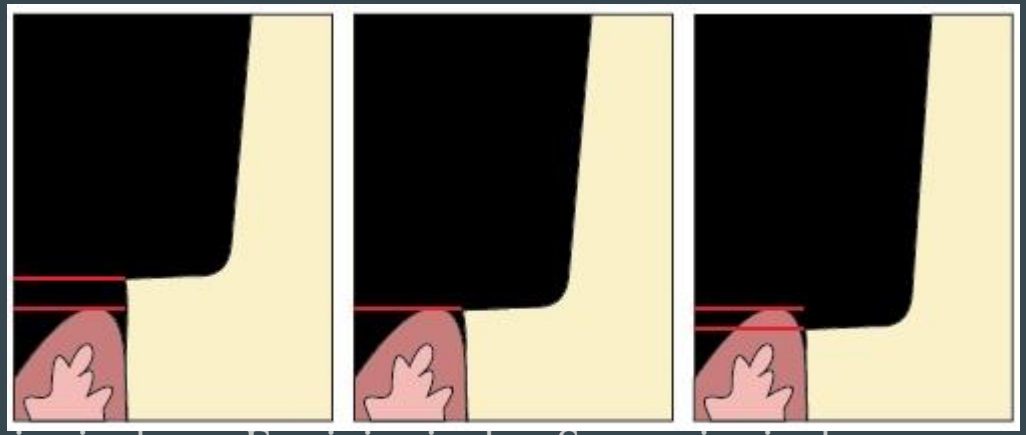
How do gingival tissues respond to different esthetic crown materials?

- Markers of Inflammation
  - Gingival crevicular fluid (GCF)
  - Interleukin one beta (IL-1β)
- Esthetic Crown Materials
  - Metal
  - Ceramic
  - Zirconia
  - PFM

https://skydental.co.in/oralhealth/types-of-crowns/

- Role of Crown Margins
  - Key aspect of successful restorations
  - Highest biologic risk association = subgingival
  - Least esthetic = supragingival

Margin Types



Subgingival Equigingival Supragingival

http://guident.net/articles/prosthodontics/PRINCIPLES-OF-TOOTH-PREPARATION:-PART-2.html

PICO

P: Patients with crowns in the esthetic zone

I: Translucent Zirconia crowns

C: Lithium Disilicate crowns

O: More translucent/esthetic crowns

PICO formatted

In patients who want esthetic crowns, are translucent zirconia crowns or lithium disilicate crowns more translucent/esthetic?

Clinical Bottom Line

-There is contradicting evidence on whether translucent zirconia or lithium disilicate is more translucent/esthetic

-An increase in translucency often results in a decrease in material strength when comparing materials of the same category. For this reason, crown material should be decided clinically on a case by case basis with all patient factors taken into consideration.

Search Background

Date(s) of Search:9/3/2020, 9/7/2020, 9/15/2020

Database(s) Used: PubMed

Search Strategy/Keywords: Crowns, Esthetic, Translucency

Search Background

MESH terms used: Monolithic Zirconia, Translucency, Lithium Disilicate

Article 1: “Translucency of IPS E.max and Cubic Zirconia Monolithic Crowns”

Citations:

Baldissara, Paolo, et al. “Translucency of IPS E.max and Cubic Zirconia Monolithic Crowns.” *The Journal of Prosthetic Dentistry*, vol. 120, no. 2, 2018, pp. 269–275.

Study Design: In-Vitro

Study Need/Purpose: To evaluate the optical properties of two types of zirconia to lithium disilicate glass ceramic

Article 1 Synopsis:

Method: Two samples of each material were milled to thicknesses of 1.0 and 1.5mm. Samples were placed in a dark chamber with an LED light directed through the crown and translucency was measured in terms of total light transmission using a photoradiometer.

Results: Tt values (illuminance values) shows that total transmission of light was higher in the two Zirconia samples than in the Lithium Disilicate. This was true for both thickness values.

Article 1 Synopsis:

Conclusions: Both types of Zirconia demonstrated higher translucency values than the Lithium Disilicate. These results were statistically significant. This suggests that translucent Zirconia would provide a more esthetic restoration for the patient.

Limitations: This was an In-Vitro Study. In addition, the sample size was limited (19 units per group).

Reason for Selection of Article 1:

-Article directly compares the two materials in question in a controlled environment and with all other factors kept constant

-Research is current (2018) and is published by a credible journal

-Directly applicable for treatment planning this patient's case

-Implications include selecting the best material to create the "pretty smile" the patient desires

Article 2: "A comparative evaluation of the translucency of Zirconias and Lithium Disilicate for Monolithic Restorations"

Citations:

Harada, Kosuke, et al. "A Comparative Evaluation of the Translucency of Zirconias and Lithium Disilicate for Monolithic Restorations." *The Journal of Prosthetic Dentistry*, vol. 116, no. 2, 2016, pp. 257–263.

Study Design: In-Vitro

Study Need/Purpose: To compare the translucency values of five different types of zirconia and one type of lithium disilicate

Zirconia: Katana UT, Katana ST, Katana HT, Prettau Anterior, and BruxZir

Lithium Disilicate: E. Max Ivoclear Vivadent AG

Article 2 Synopsis:

Method: A spectrophotometer with an integrating sphere was used to evaluate the total transmittance of light as a percentage. Tt (illuminance) values were used to determine the light transmission with higher Tt percentages corresponding to more illuminance.

Results: The Lithium disilicate showed a statistically significant higher percentage of light transmission than all five types of zirconia. Katana UT had the highest light transmission of all zirconia samples and this was also significant.

Article 2 Synopsis

Conclusions: Lithium disilicate is more translucent than high-translucency zirconia and would therefore be the more esthetic crown material. If zirconia is used, Katana UT is a more esthetic zirconia than all other types tested.

Limitations: Lithium disilicate requires at least 1.5 to 2.0 mm of occlusal thickness for its success and survival and this material thickness was not tested in this study. In addition, this was an in-vitro-study.

Reason for Selection of Article 2:

-Again, the article directly compares the two materials in question in a controlled environment and with all other factors kept constant

-Goes even further as to compare several types of the SAME material (translucent zirconia) in their proposed translucency

-Research is current (2016)

-Directly applicable for treatment planning this patient's case and has implications for creating the most esthetic restoration possible

-Can help the provider choose a specific type of translucent zirconia if they choose to use this over lithium disilicate

Article 3: “Comparison of the Mechanical Properties of Translucent Zirconia and Lithium Disilicate”

Citations:

Kwon, Sung Joon, et al. “Comparison of the Mechanical Properties of Translucent Zirconia and Lithium Disilicate.” *The Journal of Prosthetic Dentistry*, vol. 120, no. 1, 2018, pp. 132–137.

Study Design: In-Vitro

Study Need/Purpose: To compare the translucency (as well as several other properties) of two different types of Zirconia to Lithium Disilicate

- -5-mol yttria-stabilized zirconia
- -3-mol yttria-stabilized zirconia

Article 3 Synopsis

Method: Samples of each material were prepared to a thickness of 1.0mm and placed against both a white and black background and a spectrophotometer was used to measure the light transmission. Two samples of each material were used and the values were averaged to compare between materials.

Results: Lithium disilicate demonstrated significantly higher light transmission than both zirconia samples. However, Lithium Disilicate was also shown to have a significantly lower flexural strength than both types of zirconia.

Article 3 Synopsis

Conclusions: The lithium disilicate had the highest translucency of the three and would therefore be considered a more esthetic material. However, Lithium Disilicate was shown to be a weaker material. When comparing the two types of zirconia, the 5-mol yttria-stabilized was shown to have the higher translucency and also demonstrated no measurable material wear, which could also contribute to increased esthetics over time.

Limitations: Zirconia samples were wet-sectioned which contributes to increased opacity. This could have influenced the results by making the material appear less translucent. In addition, Lithium disilicate was once again tested at a thickness of 1.0mm which is not thick enough for its clinical success.

Reason for Selection of Article 3

-Again, the article directly compares the two materials in question in a controlled environment and with all other factors kept constant

-Research is current (2018) and is published by a credible journal

-Directly applicable for determining the crown material for this patient's case and has implications for creating the most esthetic restoration possible

-Can help the provider choose a specific type of translucent zirconia if they choose to use this over lithium disilicate

-Also tests the strength of these two materials which is clinically applicable in treatment planning to meet all of the patient's needs

Lay Literature

-Simple google search of “what is the best crown material”

-Results show that ceramic crowns produce the “most beautiful and lifelike cosmetic result”

-May have to explain the fact that there are different types of ceramic crowns to the patient

-Patient will likely not have in-depth knowledge on these specific ceramic types, leaving more responsibility to the dentist

Source: Rich , Martha. “A Comparison of Dental Crown Materials.” *Dr. Martha Rich, DMD - A Comparison of Dental Crown Materials - Portland, OR - A Comparison of Dental Crown Materials - Dentist Portland OR.*

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

How does the evidence apply to this patient?

The literature tells us:

There is contradictory evidence when comparing the translucency values of zirconia and lithium disilicate. However, all studies demonstrate that an increase in translucency often results in a decrease in material strength when comparing materials of the same category.

This patient: Is not a bruxer/does not grind and is interested in crowns in the anterior region where forces are lower, therefore we can use high translucency materials, even though this will result in a reduced strength

Sources:

Baldissara, Paolo, et al. “Translucency of IPS E.max and Cubic Zirconia Monolithic Crowns.” *The Journal of Prosthetic Dentistry*, vol. 120, no. 2, 2018, pp. 269–275.

Harada, Kosuke, et al. “A Comparative Evaluation of the Translucency of Zirconias and Lithium Disilicate for Monolithic Restorations.” *The Journal of Prosthetic Dentistry*, vol. 116, no. 2, 2016, pp. 257–263., doi:10.1016/j.prosdent.2015.11.019.

Kontonasaki, Eleana, et al. “Monolithic Zirconia: An Update to Current Knowledge. Optical Properties, Wear, and Clinical Performance.” *Dentistry Journal*, vol. 7, no. 3, 2019, p. 90., doi:10.3390/dj7030090.

Kwon, Sung Joon, et al. “Comparison of the Mechanical Properties of Translucent Zirconia and Lithium Disilicate.” *The Journal of Prosthetic Dentistry*, vol. 120, no. 1, 2018, pp. 132–137., doi:10.1016/j.prosdent.2017.08.004.

Rich , Martha. “A Comparison of Dental Crown Materials.” *Dr. Martha Rich, DMD - A Comparison of Dental Crown Materials - Portland, OR - A Comparison of Dental Crown Materials - Dentist Portland OR*.

Crown Materials available at MUSOD

All Ceramic Crown

- Lava Zirconia (layered)
- Lava Plus FC (monolithic)
- Nu-Art Zirconia (monolithic)
- Lava Ultimate (compositeA)
- Imagine Zirconia (monolithic)
- IPS E-max (layered)
- IPS E-max (monolithic)
- IPS E-max Veneer
- IPS E-max Inlay/Onlay

Porcelain to Metal Crown

- Noble White (pallidum)
- High Noble White Gold
- High Noble Yellow Gold

Full Cast Crown

- Noble White
- Noble Yellow 2%
- White Gold (high noble)
- Yellow Gold (high noble)

Conclusions D4

How will you advise the patient?

I would advise the patient that the most esthetic/translucent crown material is lithium disilicate (IPS E-max layered). I would make sure to send her to the lab to directly shade match and give her the option of placing a lithium disilicate veneer on #9 to have more control over shade matching, symmetry and ideal proportions. We will place the margins subG to aid in esthetics but make sure to emphasize the need for proper OHI. We talked to perio and she would be a candidate for crown lengthening however she is 73 and has a low smile line so we opted against it.

Discussion Questions

Do different crown materials stain differently? If so, which material stains similarly to teeth? In the instance of a heavy coffee drinker, would this be important?

Is one type of crown material better than the other in terms of their mechanical properties and long term success rate?

What properties of different restoration materials contribute toward the esthetics, besides translucency?

Are specific crown materials suggested in certain gingival conditions?

If a patient needs a large build up prior to a crown placement, what buildup material would be the most aesthetic for translucent crowns?

Esthetic Considerations

Dental esthetics

- Size (width, length, WL ratio)
- Proportion (central: lateral: canine)
- Gross anatomy (tooth shape, alignment)
- Shade (color, **translucency**)
- Surface anatomy (groove, texture)

Dento/Facial Esthetics

- Facial form (dentofacial, mesiofacial, bradyfacial)
- Transverse and vertical facial proportions
- Tooth position & alignment in relation to the lips (transverse, anteroposterior, and vertical position, occlusal plane angulation, posterior arch width
- Smile eval (smile type, position of the incisal curve relative to touching the lower lip, parallelism of max incisal curve with the lower lip, # of teeth displayed)

Incisal halo effect

- ✓ The halo is a reflection/refraction of light off the internal lingual–incisal enamel surface and is not a concentration of stain or of more opaque enamel.
- ✓ The scattering halo effect will occur in natural teeth where there is buccal-facing lingual-incisal surface of enamel at the right angle.

Clinical Cementation

Lithium Disilicate

- Etch intaglio 5% hydrofluoric acid 20s (bc glassy matrix)
- Silane to intaglio 60s, air dry
- Enamel? Etch with phosphoric acid
- Primer to intaglio 30s, air dry
- multilink automix- self curing luting composite resin cement (don't use temp cement with eugenol)
- Light cure 20s
- Glycerin gel- avoid oxygen inhib zone
- Difficult to remove resin cement.

Zirconia

- air abrade intaglio (pat annis)
- Lute/bond zirc?
  - Zinc phosphate cement- lute
  - RMGI
  - Resin- bond

Mechanical Properties

Lithium Disilicate		Zirconia
Closer to human enamel	<	flexural strength and fracture toughness
		Thermal/fatigue/chem degradation (least reliable)
Closer to human enamel	<	Wear resistance
Glazed causes more wear than polished	>	Antagonist wear (human enamel)
Close to human enamel	<	Stiffness- super rigid
Predictable bonding- high bond strength	>	

Comparable: optical properties, accuracy, biocompatibility, tooth reduction

Questions?