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## 4 Burning Questions on Restorations with Ceramic or PFM Crowns

By Jeffrey Bonk on March 25, 2020 | [SHARE](#)



As a Spear Resident Faculty member and instructor in the “Restorative Design” workshop , I receive many questions from attendees about ceramic vs. porcelain-fused-to-metal (PFM) restorations. The questions Dr. Bob Winter and I receive in the workshop often center around which is better and how to communicate the options to patients.

In the workshop, Dr. Winter and I address these issues and concerns in detail. We are all confronted with treatment decisions each day in our practices. We must make choices that are in the best interest of our patients and provide predictability and longevity.

In the “Restorative Design” workshop, we review restorative preparation design that correlates directly to restorative materials. These concepts are covered in detail. The objective is to provide attendees with the confidence in preparation technique as it relates to selection of materials. It not so much a matter of which is better, but more a matter of which – ceramic or PFM – is more appropriate for a given circumstance.

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The bottom line is about outcome! Once the specific outcome objectives are delineated, the material of choice may then be determined. An “outcome-based mindset” is the defining

parameter of the workshop.

PFM restorations have been the “go-to” esthetic restorative restoration in dentistry for more than 40 years. Yet while they have served patients well, there are some deficiencies and limitations that contribute to less than ideal appearance and function.

More recently, all-ceramic restorative materials have evolved as alternative material choices for restorative solutions. As “sexy” as it is as a material, all-ceramic options contain both positive and negative factors as a restorative alternative.

I recently received a series of common ceramic vs. PFM questions from a workshop attendee. Here are the questions followed by my responses:

## Can I tell the patient that the zirconia crown is stronger than the PFM crown?

Yes, the zirconia crown is stronger than PFM crowns! There are different types of zirconia crowns that exist - high-strength (BruxZir type) and low-strength (translucent). Both types are stronger than PFM crowns (relative to the porcelain).

It's helpful to understand the values for compressive strength of restorations:

- High-strength zirconia (1,000-1,200 megapascals)
- Low-strength zirconia (600-800 megapascals)
- e.max lithium disilicate (400-500 megapascals, but note the difference between bonded and cemented e.max)
- PFM (80 megapascals, with the layer of glass ceramic fused to the porcelain)

A megapascal equals 143 pounds per square inch. This does not relate to shear force, which would be weaker. These values are accurate for restorations with appropriate (manufacturer recommendations) thickness of material under load force. These values would be applicable if you have prepared the tooth preparation properly and provided adequate reduction.

If there is inadequate tooth reduction (e.g. under-preparation), there is significant possibility of fracture or failure under loading force. Proper preparation is key based on the type of material. Porcelain of any type is weak by nature of its crystalline structure without adequate/appropriate thickness.

By strength alone, you can see the zirconia restoration is stronger. That is not to say that PFM crowns do not work or are not strong. By the nature of the metal underlying the layered porcelain, there is significant strength or resistance to crown fracture. If a zirconia crown fractures, it is catastrophic, in that the crown must need to be replaced since the tooth is exposed due to the fracture. But if the porcelain of a PFM crown fractures, it may not require complete replacement of the crown. The underlying metal will continue to protect the tooth substrate from the oral cavity.

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Each situation is different. A clinical decision will need to be made regarding replacement, repair or observation. The metal of the PFM crown is by far stronger than the zirconia restoration. The decision to use the zirconia or PFM crown must be determined by reasons other than strength alone.

For example, a PFM crown may be the restoration of choice in order to block out a dark tooth substrate for esthetic reasons. A ceramic restoration requires greater ceramic thickness in order to block the underlying dark tooth. Inadequate ceramic thickness may result in a low value, or “greyish,” appearance of the final restoration. Again, the restorative material you choose is essential to achieving your desired clinical outcome (strength, appearance, longevity, etc.).

## **Can I tell the patient that the zirconia crown will last longer than PFM crown?**

Some of my answer to this goes back to the first question regarding tooth preparation depth and strength of material. If there is inadequate depth of prep, the ceramic restoration may fail prematurely.

Additionally, if the metal of the PFM crown is too thick (e.g., the lab fabrication did not reduce the metal thickness adequately, since it can be as thin as 0.1 mm), the fused layered porcelain can also fracture prematurely. Proper planning and design, along with adequate preparation thickness will determine life of the restoration. Again, preparation design and restoration design are key to long term success.

The preparation margins are also key to success. The smoother and more refined the preparation margins, the better the crown adaptation and longer the life span. Creating smooth and precise margins requires adequate magnification, proper design and use of the rotary burs during preparation. The recommended minimal magnification for proper vision and efficiency is 4.5 power.

Either magnification loupes or a microscope will provide the adequate vision. Below this level of magnification, it is very difficult to achieve smooth and precise contours of the preparation. These refined margins translate to minimal preparation margin gap and cement thickness. Ideally, we want to create margins in the 25-50-micron range. Whether analog or digital impression techniques are applied, the key is smooth and precise margins to attain restoration longevity.

## **Will a zirconia crown wear the opposing teeth?**

Yes and no! We have known for a long time that unpolished ceramic (whether it is glass ceramic, lithium disilicate or zirconia) is abrasive to opposing tooth structure. The literature contains many references to this fact (I would recommend Jagger and Harrison’s “An invitro investigation into the wear effects of unglazed, glazed and polished porcelain on human enamel,” J Prost Dent. 1994; 72: 320-323).

That 1994 article discusses the importance of polishing porcelain (even glazed porcelain) to prevent attritional wear of the opposing teeth. Opposing tooth wear is a major consideration

relative to the use of any ceramic material. Proper adjustment and polishing are critical for both occlusal stability and longevity. Wear studies show that deterioration of opposing surfaces is linked to the frictional coefficient of materials.

This is directly related and influenced by surface roughness. Two rough opposing surfaces will have higher frictional coefficients. Rough zirconia has a higher frictional coefficient against enamel than polished zirconia (see the Goo, 2016 reference below). Properly polished ceramic is less damaging to the opposing tooth enamel!

Virtually all restorations require occlusal adjustment to gain proper functional contact. Adjusting ceramic is something all dentist perform regularly. Care must be taken to not create flaws in the ceramic during the process of adjustment. Surface and Sub-surface damage from grinding on ceramic is well documented in the literature.

Here are some additional references that you may look at to gain greater insight into the effects of ceramic and opposing tooth wear.

- Goo, Chui Ling, et al. "Effect of polishing systems on surface roughness and topography of monolithic zirconia." *Operative Dentistry* 41.4 (2016): 417-423.
- Oh, Won-suck, Ralph DeLong, and Kenneth J. Anusavice. "Factors affecting enamel and ceramic wear: a literature review." *The Journal of Prosthetic Dentistry* 87.4 (2002): 451-459.
- Song XF, Yin L, Handy, Wang H. "In vivo rapid intraoral adjustment of porcelain prostheses using a high-speed handpiece." *Acta. Biomater.* 2008;4(2) 414-424
- Yip, Kevin H-K., Roger J. Smales, and John A. Kaidonis. "Differential wear of teeth and restorative materials: Clinical implications." *International Journal of Prosthodontics* 17.3 (2004).

## **How do we convince patients that all ceramic crowns, like zirconia and e.max crowns, are better than PFM crowns?**

My belief is that we do not need to "convince" patients that one type of restoration is better than the other. As restorative dental professionals, we must decide the best solution based on the situation. It is not up to the patient to decide.

Restorative success is not about the type of crown or material that is utilized, although that is a factor. It is about understanding the desired outcome and then selecting the appropriate services necessary to attain that outcome. The selection of crown material is only one of many decisions that are required to gain longevity and success with restoration. Treatment planning for longevity requires much more than simply determining which crown material to use.

It is paramount to apply the concepts of Facially Generated Treatment Planning (FGTP) to the overall dental health of the patient. Consideration of the integrated components of esthetics, function, structure, biology (EFSB) must be applied directly to each individual tooth to achieve a desired outcome. For example, with restoration of a first bicuspid:

- Esthetics: Evaluate and determine the desired shade vs. initial shade. What is the previous restoration? Amalgam? Did it stain the tooth substrate dark? Is the buccal corridor narrow and requires increased dimension?