

TECHNICAL WHITE PAPER

ZIRCONIA

Do you need to choose between
strength and aesthetics?

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Introduction

When full contour zirconia entered the dental marketplace its primary benefit was strength. The advertisements made it appear as though the material was unbreakable. After several years of clinical experience we now know that this impression is not true. However, the frequency of fractures was low and full contour high translucency zirconia rapidly became the dental restorative material of choice.

The introduction of super translucent zirconia was heralded as an aesthetic alternative to IPS e.max[®]. While the material attained some market share, the growth was hampered by the material's low strength. Some clinicians reported a higher fracture rate with this type of zirconia and it became apparent that not all zirconia types were the same.

Background

Unlike alloys that are classified as High Noble, Noble or Predominately Base, zirconia has no formal classifications. Also, unlike alloys, zirconia can be unforgiving to an insertion error because it does not flex. Applying pressure at a slight angle offset from the proper insertion angle will result in the zirconia unit fracturing as shown in Figure One. Similar PFM restorations would seat without difficulty because of the alloy's elasticity.

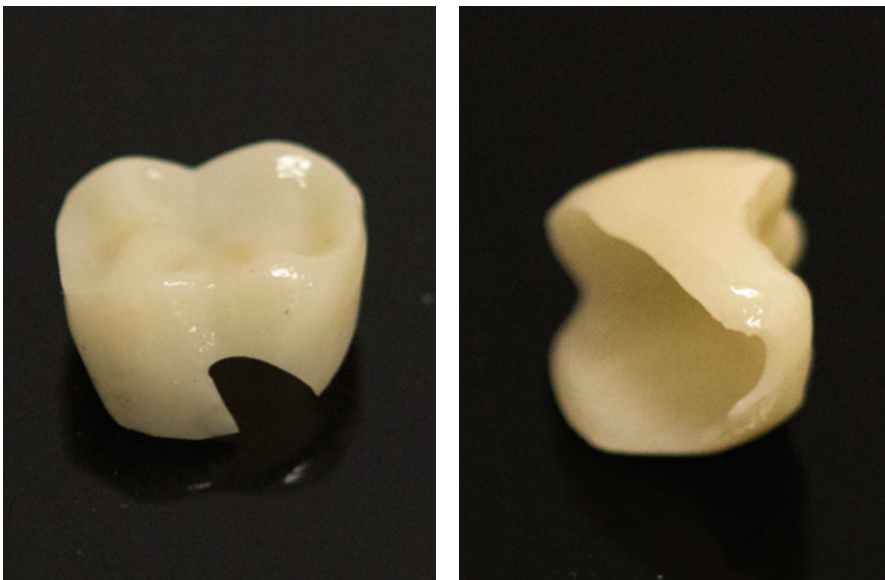


Figure One

ZIRCONIA

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Molars are particularly susceptible to fracture because the occlusal fossa acts as a natural stress riser, which focuses any applied stress at the weakest part of the crown as shown in Figure Two.

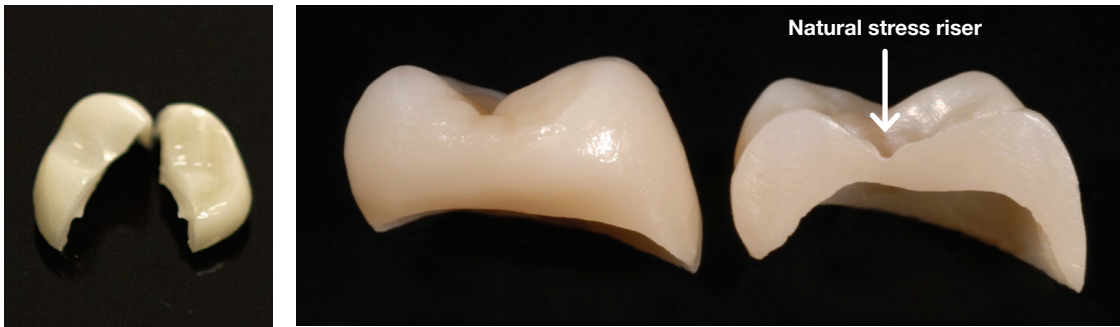


Figure Two

Another reason molars fail more often is that the cusps are adjusted more frequently than other units. Using a high speed hand piece without water will create micro-fractures that may result in catastrophic failure after insertion.

Experiencing fractures in vivo may push one to sacrifice aesthetics for strength, but it doesn't need to be the case. At Argen, we have experimented with combinations of the strong high-translucent zirconia (HT) and the very aesthetic super translucent zirconia (ST).

The two factors, strength and translucency, were studied.

Figure Three shows the translucency results for the combinations. Not surprisingly, the translucency is a linear result for any combination of HT and ST zirconia. This means that we can easily determine the composition for any desired translucency.

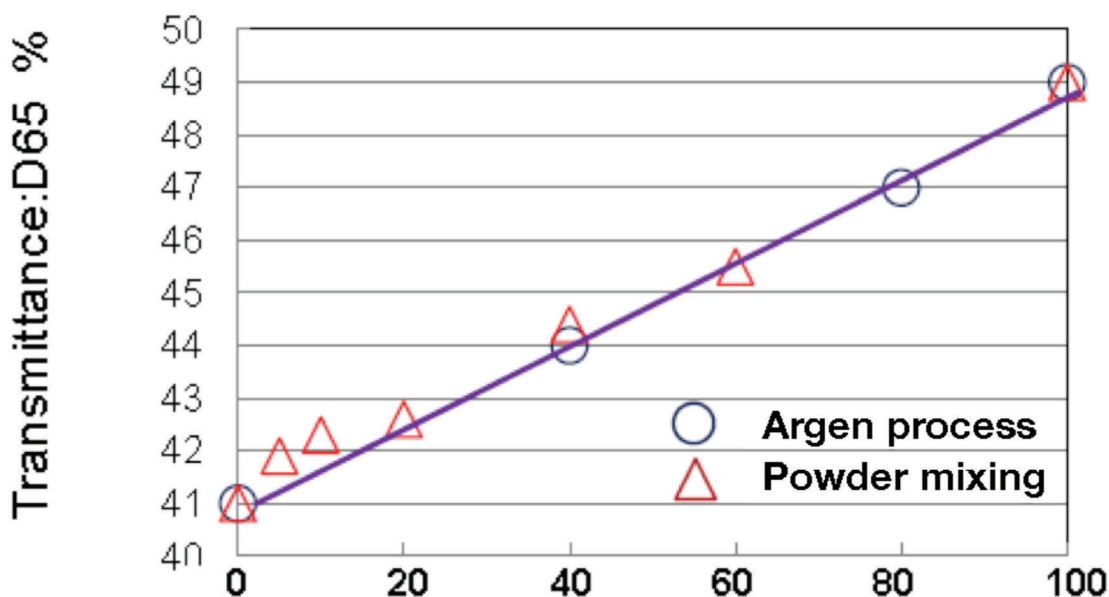


Figure Three

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The strength results, however, were very different depending on how the HT and ST zirconia were blended. Figure Four shows that adding the ST zirconia can decrease the strength rapidly if merely blended.

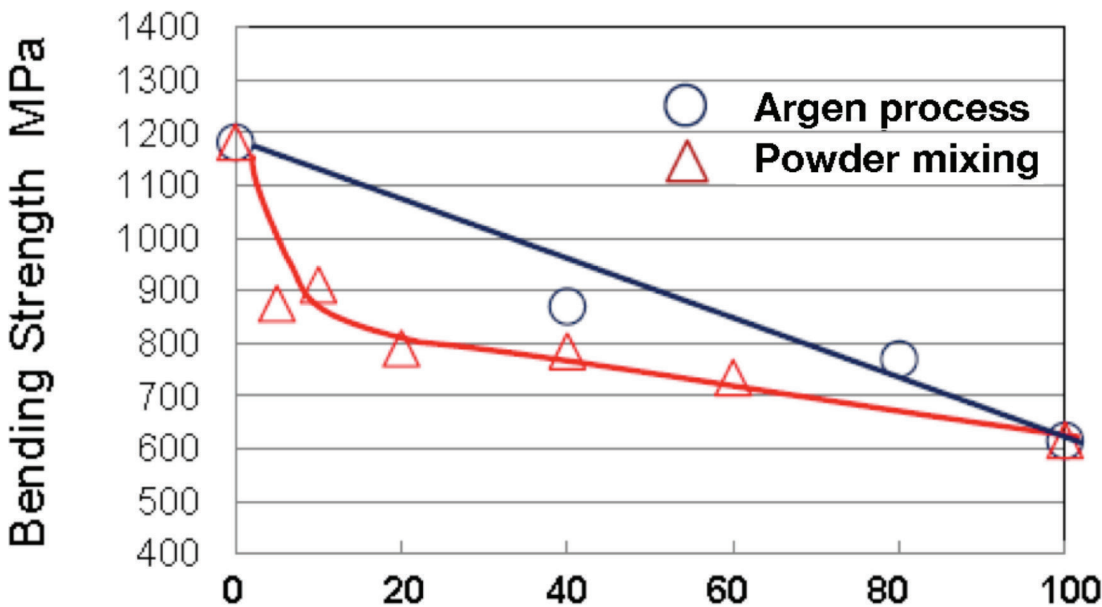


Figure Four

Solution

At Argen, we discovered a process for improving the translucency of the HT zirconia and increasing the strength. This product is named ArgenZ HT+. The table below shows how the new material compares to BruxZir Full Strength and ArgenZ Esthetic zirconia.

	BruxZir Full Strength	ArgenZ Esthetic	Argen Z HT+
Average Flexural Strength	1100 MPa	1100 MPa	1250 MPa
Translucency	35%	40%	45%

Despite initial perceptions that zirconia was unbreakable, clinical experience has demonstrated otherwise. Since zirconia does not flex it is susceptible to fracturing under certain circumstances. The proper blend between strength and translucency must be achieved in order to provide a viable restoration solution.

Conclusion

ArgenZ HT+ provides the assurance of higher strength **and** better aesthetics, resulting in fewer fractures while mimicking the aesthetics of natural dentin.



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