Manufacturer matters when it comes to ceramic abutments

An interview with Prof. J. Robert Kelly

by Nobel Biocare

A new study conducted by leading materials scientist Prof. J. Robert Kelly has confirmed that not all dental implant restorations are created equal. In this interview, Kelly discusses the research, which has very recently been published in the International Journal of Oral and Maxillofacial Implants.

The findings make a positive reading for NobelProcera customers.

Nobel Biocare News: Your latest research tested the fatigue behavior of zirconia implant abutments from four major manufacturers. What led you to take this approach?

Prof. J. Robert Kelly: We wanted to study commercial products not in order to make commercial comparisons, but to study realistic products. Our goal was to look for commercial comparisons, but to study realizations, not in order to make manufacturers only produce hybrid zirconia abutments that have a titanium insert interface to the implant—and the available abutments from Astra and Straumann that are fully zirconia.

What was your methodology for testing these products?

For the first phase, we first took six of the abutments in each of the four groups and tested them with repeated loads of 200 N. We chose 200 N for the accelerated aging based on our previous work. We did not want to break the implants, so we thought that was a fair load to start with. The results then allowed us to design the second phase, by determining the loads that we would use in testing with another 12 implants.

However, by the time we received the data from the first phase, we were astounded. There were clearly significant differences between manufacturers in each of the categories. This was subsequently verified in full-sample testing.

You found that the NobelProcera product outperformed the other abutments in this test significantly.

Yes, absolutely. While we had to rework the load with some of the other abutments, with the NobelProcera product, we ran out no fractures at 7.5 million cycles, so the load had to keep going higher and higher.

How would you explain this apparent weakness of the other abutments?

The vast differences were unexpected, as the macro-designs are similar across the manufacturers. To help determine why we were seeing such varied results, I asked my colleague Dr. Isabelle Denry to do scanning electron microscopy analyses. Looking at one of the poorest performing abutments in the study, she identified that the weakness was the result of damage arising from the manufacturing process—subsurface grinding damage, large cracks, inhomogeneous crystals and a diffuse layer of porosity. From this, it was evident that manufacturer matters.

There are many reports of issues caused by third-party abutments being used with a system that they were not designed for. Considering that manufacturer matters, do you advocate using only authentic components?

In general, I advise against using lower cost third-party abutments. There is too much to lose. From what we have seen over the years, the quality of the materials is inferior, and the outcome has such a high value; the patient has very high expectations of the clinician—why would you risk that to save $100?

Considering that the NobelProcera abutment for BL implants outperformed all of the others, what are your thoughts? NobelProcera is produced in a high quality process, since Nobel Biocare fabricates components that are designed, tested and then verified for the BL implant system.

References:


Zirconia abutments with titanium base

NobelProcera

1,000,000,000,000,000,000,000,000,000

GlideWell

1,000,000

1 million cycles

Extrapolated cycles for 10% failure at 70% (expected clinical load)

Full zirconia abutments

Straumann

30,000,000

30 million cycles

Atlantis

20,000,000

20 million cycles

“Manufacturer matters”: the four abutments look very similar in clinical examination, but differed significantly in performance, indicating the impact of design and production method.


* Zirconia abutment D1.