Clinical Experience with PEEK Infrastructure: Short-Term Results of an Ongoing Prospective Study using the JUVORA™ Dental Disc

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*Carlos Moura Guedes, DDS, spoke at a tri-lateral meeting of EAO 26th Annual Scientific Meeting, SEPES 47th Annual Congress and 5th SEPA European Symposium, October 5 - 7, 2017, Madrid.** This is a summary of Dr Guedes' presentation.*

For the last 20 years, our main objective at the MALO CLINIC has been to achieve a simple and cost-effective procedure for providing fixed teeth to edentulous patients. We would like those fixed teeth to be in place immediately, at the time of the surgery – and with high success rates, both for the implants and also for the prosthodontic rehabilitation.

We have attained these objectives with two different protocols. The first was the All-on-4™ protocol; it is a surgical protocol that allows us to use implants to achieve the correct support for our bridges. The second is the MALO CLINIC bridge, which has been developed specifically for the All-on-4 surgical protocol and allows the patient to have fixed teeth that are both highly functional and highly aesthetic (Figure 1).

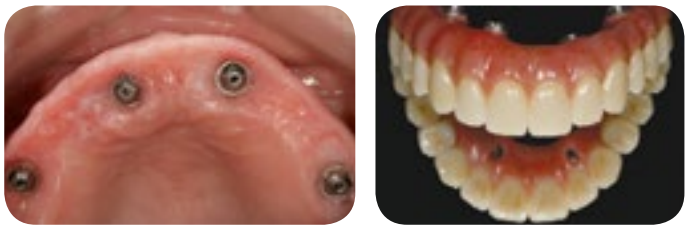

Figure 1: All-on-4 procedure with MALO CLINIC bridge.+

Cases can be Problematic

Of course, not all cases are straightforward. We have situations where, for example, patients are heavy bruxers, with parafunctional habits. We have fractures of the material, including fractures of the ceramic, and breakages of the teeth. In the worst-case scenario, we can even have fractures of the titanium framework.

In one particular case, the challenge was to replace the titanium infrastructure (which was very rigid) with a PEEK infrastructure (made with the JUVORA CAD/CAM Dental Disc from Invibio Biomaterial Solutions™). Then we could see if, given the resilience of the PEEK material, we could absorb some of the loads that were causing damage both to the crowns and to the veneer material.

First, we did a pilot study with only four patients, with five prostheses. One of the mechanical complications we then saw in these five prostheses was the deformation of the PEEK material when we torqued the prosthetic screw. We had to find a solution to this before we could start our study. The solution we devised was to include titanium sleeves, placed occlusally where the prosthetic screw is tightened. Doing this, we were not applying pressure to the PEEK material, but instead to the titanium sleeve. We incorporated these titanium sleeves with every bridge, from this point on.

Following the Healing Phase

After the healing phase we waited between four to six months, according to the type of bone the patient presents, and we then start making our definitive impressions. When using CAD/CAM techniques, we always try to use models that are as precise as possible, so we use a ferrulized technique for the impression copings, to try to have the most precise model possible. This is the starting point for every case, the final models. Using the immediately positioned provisionals, we then cross-reference the final master casts with the models of the provisionals. We try to provide as much referencing as possible, so that the technicians can start to build the new and final bridges. We can remove these models in order to make the silicone indexes, or now that we have the digital process, we can scan the provisionals and have the design made entirely by CAD. We can also use a more manual and traditional approach and design the PEEK infrastructure using the silicone indexes.

The Prospective Study

For the prospective study, which is ongoing, we had 37 patients, which meant 49 prostheses, because some of the cases were bimaxillary. We studied two essential outcomes. The primary one was prosthetic survival – determining whether all the prostheses had survived, or if some need to be replaced. The secondary outcomes were also extremely important, and here we checked implant survival, while also looking for technical, mechanical and biological complications.

We had one prosthesis that had to be replaced due to a fissure that occurred in the cylinder area. It was No. 35, on the left side. This meant that we had a 98% survival rate for the prostheses. Regarding the secondary checks, we had some technical complications, as we had anticipated, because when we change the materials and also the techniques, there's a learning curve. The more evident technical complications were veneer-adhesion issues. We found this type of issue in six patients, with seven prostheses affected. This indicated debonding of the acrylic teeth from the pink infrastructure.

We made three changes to obtain better results. The first, and the most important, was to change the bonding primer. When we did that, we immediately stopped having this type of problem. Another measure was to increase the mechanical retention of the PEEK material, to increase the adhesion. We also increased the thickness of the PEEK, in order to reduce the flexibility of the material and to make it more compatible with the acrylic teeth

Mechanical and Biological Complications

In terms of mechanical complications, we also had fractures of the acrylic teeth without exposure of the infrastructure. This exact complication occurred in a patient that had a fissure in the PEEK infrastructure. Here, the solution was to improve the design, to increase the thickness of the PEEK and give it more resistance. The other problem we saw, and sometimes this also happens with the titanium frameworks, was the loosening and fracturing of the prosthetic screws. That occurred in two patients and in three prostheses. Here we controlled the occlusion. We changed the screws; we re-tightened them, and this particular problem never recurred within the observation period. In some areas, especially in those areas where we have the cantilevers, we needed to increase the thickness of the PEEK to gain more resistance in a particular area.

The other factor we wished to test was the use of different veneer materials in combination with PEEK. We changed the veneering material from acrylic to ceramic, and this resulted in a completely different design of the PEEK framework, compared to those where we wrap around with acrylic.

We had excellent biological results. The bone loss was 0.5 to 1.13 mm, and for the tilted implants, 0.43 to 1.14 mm (Table 1). These are very good values, indicating that the bone is responding really well to the PEEK polymer.

Biological Complication	Axial Implants	Tilted Implants
Marginal Bone Loss	0.51 - 1.13mm	0.43 - 1.14mm

Table 1

These one-year results mean that we at the MALO CLINIC are very happy with the performance of PEEK. Regarding patient satisfaction, the response has also been extremely positive. Patients tell us they feel very comfortable. ▲

ABOUT THE AUTHOR

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Carlos Moura Guedes, DDS, is a Director of the MALO CLINIC, Lisbon, Portugal. Dr. Guedes has a degree in Dental Medicine from Faculdade de Medicina Dentaria de Lisboa in Portugal and a PhD from the University of Granada. Dr. Guedes has been an invited guest speaker at international conferences on topics such as Oral Rehabilitation, Fixed Prosthodontics, Interdisciplinary Treatments and Aesthetics.

* Since 2016, Carlos Moura Guedes, DDS , has provided ad hoc consultancy services to JUVORA Ltd.

* The case studies and conclusions presented have been provided by a practicing dental specialist. His view and experiences are his own and do not necessarily reflect those of others. "Invibio" disclaims any liabilities or loss in connection with the information herein.

** EAO: European Association for Osseointegration
SEPES: Spanish Society of Stomatological Prosthesis
SEPA: Spanish Society of Periodontics and Osseointegration

[+] Images provided courtesy of Carlos Moura Guedes, DDS.

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