Titanium: THE FUTURE IS HERE

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INTRODUCTION

When a fixed zirconia full-contour four unit bridge that is over one year old begins to crack between the joint, the dentist and technician know that something out of the ordinary has happened. In this case, the patient had a heavy bite but a metal allergy which necessitated that his bridge be created using full zirconia with no layering. The prep design was excellent but the bridge simply could not withstand the constant pressure and so it cracked.

The clinician was inclined to replace the bridge with yellow precious metal in order to completely avoid this problem in the future. However, with the large pontic, the cost of the metal would be, without question, prohibitive. It seemed prudent to come up with an alternative solution.

We have all encountered complications with our restorations. But this article will deal with finding and creating a solution that is inexpensive and might just be the solution for the future. Metal is, at this writing, over $1,400 on the London market. If we order metal which contains more than 86% gold, we have to pay over $1400.00. Divided by 20 for 1DWT, labs are paying $70.00 per unit - without any mark-up! After that, at a mark-up, the cost increases per DWT. For a single unit, this cost might be acceptable, but with a long-span bridge, and a large pontic, the cost is driven upwards to about $500 – 700 dollars for yellow metal, after the lab uses about _ an ounce to create the restoration. Is there a solution to these sky-rocketing costs?

Having extensively experimented with titanium recently, the author was certain that this material might be a viable option for this patient’s case. The cost is much lower and, at a flat rate, completely predictable. Titanium is ADA approved and has been assigned code number 2794 for insurance purposes as a porcelain to titanium crown. The main problem the author has encountered is that people don’t think of it as a durable material. They are frequently worried about cracking and de-bonding. He decided to re-create the bridge for this patient using titanium instead of metal and
see if the results were pleasing and acceptable to the patient and clinician.

**Case Presentation**

(Fig. 1) presents a 4 unit CAD/CAM scanned titanium bridge from Nobel Biocare. Once the scanning is completed, the coping will arrive back at the lab within two days. Using the NobelProcera scanner, we can control the frame design. Also, we do not need wax-up, investing or divesting in this procedure. The author’s concern before his research was that a CAD/CAM titanium bridge would rock. But this has not happened! Consistently, the fit has been as solid as a glove.

In (fig. 2) using a KOMET carbide burr, the bridge copings were ground, with the author taking care to go in one direction only. The instrument makes grinding effortless, with excellent results (fig. 3). It next had to be sandblasted, using Renfert’s sandblaster at a 2-4 bar pressure (fig. 4). (Fig.5) shows us a before and after view of the technician’s sandblasting efforts and the titanium’s appearance.

One of the most important things to take into account when applying titanium porcelain is the first layer of bonder. Do not degass the coping before applying the bonder. The bonder’s importance in preventing bubbling cannot be overestimated. The author has had excellent results with GC Initial’s Titanium Bonder (fig. 6). Applied in a very thin layer to the copings and baked at 810° C, it will protect very well against porcelain and opaque bubbling (fig.7). It also provides good tolerance for the opposing teeth protection due to the low fusing temperature at which it is baked.

GC Initial’s Titanium Opaque (O-A4) porcelain was the next application in the process (fig.8) with its appearance after the first baking noted in (fig. 9). Four GC Initial Titanium porcelain powder colors (fig.10) express the range of possibilities with color and titanium. (Fig. 11) demonstrates the application of dentin and translucency modifier to the titanium understructure and its color appearance before the second baking (fig. 12). After the second baking, a layer of enamel modifier (EO-17 and E-58) was applied (fig.13) before a layer of GC Gum (fig. 14). The bridge was then ready for its third bake (fig. 15.)

In order to see the different aspects and details of tooth morphology such as occlusion table, cusp...
ridge direction, secondary ridge and dissection groove and fosse, the author painted gold powder from Renfert onto the natural teeth shown here (fig. 16). This is a continuation of his study of the harmony of natural teeth, helping him to create the titanium bridge in this case study. From root to completion, the author also fabricated right-side porcelain mandibular crowns, trying to mimic natural teeth aspect (fig. 17). In order to correctly match occlusion enamel and stain, the author used the Chairside Shade Guide (fig. 18) as his tool and then applied pink porcelain to the gum area (fig. 19) for a totally natural appearance. Proper tools are paramount as a guide for creating the best possible match with the natural teeth. To quote a very good friend of the author’s, “Always know your destination before you begin your journey.” This is true of everything – including good dentistry! Research, development and hard work will pay off by providing an effective base for the work of the future.

CONCLUSION

As mentioned in the introduction, everyone worries about bubbling and cracking when using titanium. To avoid this, the heat rate at which these restorations are baked must be well-controlled. If the metal CTE rate is higher, as it is with Nobel Biocare’s titanium at 10.6, and the porcelain CTE rate lower, as is GC’s titanium porcelain at 8.6, heating rate and time must be increased. If the metal CTE rate is lower than the porcelain’s, the heat rate must be decreased. The bonder completely solves the problems of bubbling and cracking but we still have to control our heat rate properly. With the correct tools, all labs can use titanium to their advantage, with benefits to everyone!
Fig. 1 A Nobel Biocare 4 unit CAD/CAM designed titanium implant bridge is pictured here.

Fig. 2 The KOMET carbide burrs are a great tool when working with titanium.

Fig. 3 When using the burr, remember to grind in one direction only.

Fig. 4 Titanium should be sandblasted at a 2-4 bar level.

Fig. 5 Titanium will have this appearance before and after sandblasting.

Fig. 6 Titanium bonder, applied in a thin layer, will protect against bubbling.
Fig. 7 Titanium bonder, applied in a thin layer, will protect against bubbling.

Fig. 8 Opaque porcelain was next in the application layering process.

Fig. 9 After first bake, appearance.

Fig. 10 GC Initial offers a full range of titanium porcelain powder colors.

Fig. 11 Dentin and translucency modifier was applied.

Fig. 12 Appearance after second bake.
Fig. 13 Enamel modifier was next applied

Fig. 14 GC Gum application

Fig. 15 Before third bake appearance

Fig. 16 Natural teeth painted with gold powder

Fig. 17 Technician fabricated crowns from root to completion

Fig. 18 Matching natural occlusion stain with the Chairside Shade Guide
Fig. 19 Pink porcelain was applied to the gum area