Advancements in PFM crown and bridge technology

By Matt Race

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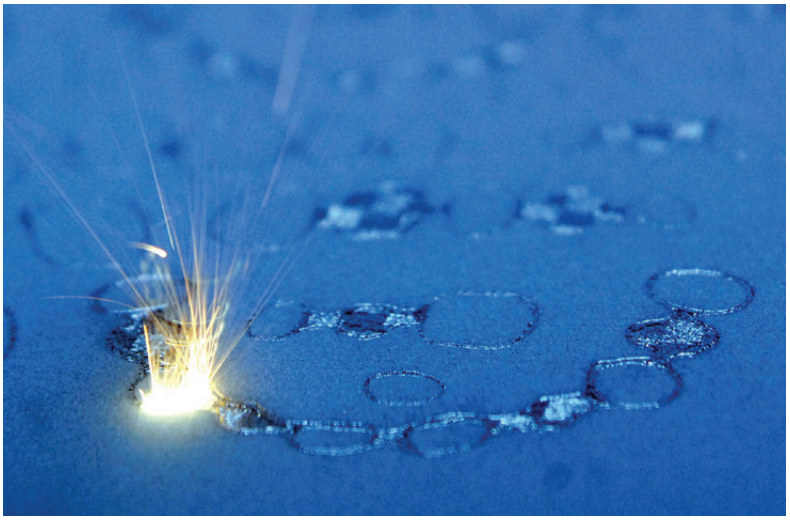
With the volatility of alloy prices in today's economy, clinicians and technicians alike are looking for ways to insulate themselves from these increasing costs. New alternatives to both precious and semi precious products, along with alternatives to traditional lost wax casting techniques can help to control variable costs.

Zirconia is an excellent, aesthetic replacement for alloy and the benefits of this outstanding material have been enjoyed for some time. However, strong demand remains for PFM restorations from dentists who prefer the tried and tested results from traditional materials.

Furthermore, in today's dental world there is a solid need for the continued use of alloys in providing crown and bridge restorations. For those who choose to continue to use metal based restorations, advances in dental technology have also delivered improvements to the final result. The main focus has been enhancing fit, biocompatibility, flexural strength and especially the density of our final products. Additionally efforts have been made to minimise wastage of alloys in the production process driven by the increasing prices for these materials.

Over the years of manufacturing dental products with casting techniques, we have endeavoured to overcome challenges such as alloy density, porosity, flowability, expansion and contraction whilst always trying to maintain a sutiable coefficient of thermal expansion. All of these issues are inherent to metal casting techniques. The importance of sprue position and design, reservoir placement, heat zone placement, correct investment techniques and the wide variations of applied temperatures attached to burn out, pre heat, melting and ring temperature can create inconsistencies in the final product. These inconsistencies can lead to faults in the finished porcelain applied crown which in turn result in its failure under the stress of normal mastication.



The question we are confronted with now is how to apply the latest technological advances to the traditional PFM restoration. Ultimately we would like to employ technology to eliminate the inherent problems associated with casting and subsequently increase the quality and lifespan of our PFM restorations. A secondary aim is to increase efficiency whilst decreasing both waste and cost. Additive manufacturing technologies have now established their place in achieving these aims.

In contrast to traditional reductive manufacturing techniques which use cumbersome and wasteful milling techniques, the relatively new world of additive technology has seen the emergence of systems which allow products to be built up layer by layer and cured or sintered between each layer. The best of these technologies outperform traditional techniques by creating a higher density metal substructure and preventing the development of problematic porosity. Efficiency and prevention of waste is unmatched.

The application of additive manufacturing technologies in the dental industry has seen the rapid growth of selective laser melting (SLM) as the method of choice for metal substructure production. SLM has enabled manufacture of metal copings in >98% dense cobalt chrome bonding alloy which has proven to be one of the fastest growing alloys for CAD/CAM PFM manufacture globally due to its excellent properties, rigidity and consistency. The purity is so much improved over traditional techniques that degass and oxidisation firing become unnecessary. The accuracy of SLM produces a variance in the order of +/- 20 microns, which is far superior to that achieved from lost wax techniques.

The bio-compatibility of alloys such as SP2 are outstanding and the lustre is equivalent to type 4 golds – soft tissue adhesion is maximised and plaque retention is minimal. The coefficient of thermal expansion is 14.0 – 14.5 x 10^{-6} m/m °C, at 25-500°C. , which means it is compatible with any porcelain that is currently used with existing precious or semi-precious alloys. All around it has proven to be an equivalent or superior product than existing precious or semi-precious alloys and can be produced at a fraction of the cost.

Finally we now have access to a manufacturing technology which enables the fabrication of metal substructures that outperform traditional techniques and delivers consistent quality every time.

SP2 alloy branded as Superium SP2 is now available from the most technologically advanced dental laboratories in Australia. ◆