



Facts

Challenge

Economic production of patient specific restorations made of a high-performance alloy.

Solution

Manufacturing of fully dense restorations without porosity by using an EOSINT M 270.

Results

- Economic: fast and cost-efficient manufacturing
- Precise: provided accuracy of the units is +/- 20 microns
- High-class: restorations are durable, capable and have a consistently good quality



Thin cross-sections of alloy powder are sequentially melted by a laser driven by this geometry, automatically building complete 3D restorations with structural fixtures not yet snapped off (Source: EOS GmbH).

BEGO USA Decides for EOS Technology to Bite Big into Changing U.S. Dental Restoration Market



e-Manufacturing Solutions

Additive manufacturing is disrupting traditional industrial technology

Short profile

BEGO USA is a division of 113-year-old German dental giant BEGO GmbH and was founded in 1991. More traditional dental products have made up 80 percent of the business. The company currently supplies laboratories and dentists around the country through some 13 distributors.

Address

BEGO USA
24 Albion Road, Suite 103,
Lincoln RI 02865 (USA)
www.begousa.com

The fine art of dental restoration rescues damaged teeth at every level of repair, from simple fillings done in the mouth to crowns, bridgework and implants that are manufactured via multiple processes away from the dentist's office. The vast industry that has sprung up around this latter type of "non-chairside restoration" is a complex and exacting business. After all, no two people's teeth are the same and every type and extent of tooth damage is unique to the individual.

Many such restorations performed today still use lost-wax technology that has barely changed in 100 years. But the restorative dentistry picture is changing rapidly as economic realities, skyrocketing gold prices and outsourced manufacturing put pressure on patients and professionals alike to find more cost-effective methods for saving smiles. The lost-wax technique seems to become obsolete.

Challenge

"We've realized that our present product line supporting lost wax is probably going to be obsolete in ten to fifteen years," predicts Bill Oremus, President of Rhode-Island based BEGO USA. "The end of casting is approaching as the application of additive manufacturing to dentistry begins to alter the landscape."

However, with an eye to the fast-approaching future, BEGO USA launched an initiative into on-site production of non-precious alloy restorations with a Direct Metal Laser Sintering (DMLS) system, purchased from leading equipment manufacturer EOS GmbH, in 2011. BEGO USA's German parent actually led the way eight years ago, being

first in the world to apply additive manufacturing to producing dental restorations. "The industry has really taken off in Europe," says Oremus. "There was initial resistance in the U.S., but the technology has now been refined to the point where we are seeing the mindset changing, and increasing enthusiasm in this country."

Wirobond C+ three-unit bridge manufactured by BEGO USA using their EOS additive manufacturing system. Support anatomy, precise marginal integrity and smooth surfaces are produced consistently from every STL file (Source: BEGO USA).



Solution

Less than a year following the setup of their EOSINT M 270, BEGO USA is producing hundreds of units a week, which are fully dense and without porosity. CAD data is a basis for this. "Our customers simply send us any open STL file of a patient's mouth scan and, after a file review step, we manufacture the coping in about 48 hours," explains Oremus. The laser sintering system, which holds a bed of powdered metal material, processes the crowns or bridges layer by layer. After a thin layer of powder was applied a focused laser beam solidifies the powder. Once a layer is completed, the powder bed drops by a fraction of a millimeter to begin the next layer. The DMLS system runs automatically, quickly and economically. It provides a typical accuracy of +/- 20 microns. While the traditional casting process can produce about 20 dental frames per day, DMLS manufacturing is scalable up to 450 units of crowns and bridges in the same time period.

"The restoration only needs some rubber wheel finishing in the margins and it's ready for veneering with ceramics. In the case of a bridge, the end product doesn't need sectioning and just drops right into place", says Oremus.

Results

"The quality of the restorations is truly excellent, the surface structure of the copings is so much better, the marginal integrity is phenomenal. Moreover, we save cost and time", enthuses Oremus. In an industry where patient specificity is critical, these qualities are obviously key. Oremus compares ten different restoration cases of long-span bridges, side-by-side, to underline this point. "If you were to put them through the old lost-wax technique you're probably looking at only 50-60% accuracy. That's a lot of do-overs, not to mention increased wait-time for the patient. Using our EOS system today, we're getting a 90-95% success rate in a lot less time."

Since their EOS system can work with virtually any properly prepared metal powder, BEGO USA has patented its own high-performance chrome-cobalt-molybdenum alloy, Wirobond C+. According to Oremus the material contains more than 20 % chromium, which, during manufacturing, creates a passivity layer that prevents the release of free ions and ensures high biocompatibility. "Whatever alloy we are working with, we find that EOS' machines are head-and-shoulders above others in terms of control of laser-beam size and effects on different restoration geometries and materials."

The fact that laser sintering systems can be run with a wide variety of registered/validated

materials is also of particular interest to the dental industry, which is always on the lookout for alloys with improved characteristics.

"Durability and performance are key in restorations," says Oremus. "The muscles of the jaw generate huge amounts of force on teeth and they have to withstand thermal expansion and contraction."

Whatever the materials, DMLS uses less of them than more traditional manufacturing methods. "A major advantage is the cost-effectiveness of the build-up technique versus so many of the other CAD/CAM processes that are subtractive techniques via milling or pressing," says BEGO USA's CAD production manager Ryan LeBrun. "When you get into high-end metals, you're looking at portions of your profit just ground away. But there's almost no waste with additive manufacturing. We can filter any extra unused powder and reuse it on the next production run. We're able to pass our savings on to the laboratory and the technician to help give them a better profit picture."

What's more, says Oremus, other advances in the digitalization of dentistry are primed to support the acceptance of the technology. "The use of chairside mouth scanners will make CAD modeling increasingly common and further drive the use of additive manufacturing in dentistry."

"The EOS technology gives us a step forward over the competition right now because we're able to do larger bridges with more than three or four copings in a row. The quality of the restorations is truly excellent, the surface structure of the copings is so much better, the marginal integrity is phenomenal."

"Whatever alloy we are working with, we find that EOS' machines are head-and-shoulders above others in terms of control of laser-beam size and effects on different restoration geometries and materials."

Bill Oremus,
President of BEGO USA

EOS systems are able to manufacture medical devices. However, EOS cannot offer any guarantee that these devices meet all requirements.

EOS GmbH
Electro Optical Systems
Corporate Headquarters
Robert-Stirling-Ring 1
82152 Krailling/Munich
Germany
Phone +49 89 893 36-0
Fax +49 89 893 36-285

Further EOS Offices

EOS France
Phone +33 437 49 76 76

EOS India
Phone +91 44 28 15 87 94

EOS Italy
Phone +39 02 33 40 16 59

EOS Korea
Phone +82 32 552 82 31

EOS Nordic & Baltic
Phone +46 31 760 46 40

EOS of North America
Phone +1 248 306 01 43

EOS Singapore
Phone +65 6430 05 50

EOS Greater China
Phone +86 21 602307 00

EOS UK
Phone +44 1926 62 31 07

www.eos.info • info@eos.info

Think the impossible. You can get it.



e-Manufacturing Solutions