No Tension in the Bridge

Laser Cusing | Additive manufacturing in dentistry is a good way to get to individual dental prostheses. The costs drop by about half. This technology also gives dental technicians more freedom, allowing them to provide reinforcement that they would otherwise not be able to achieve with model casting.

The Fresdental production center located near the Spanish city of Alicante is an example of the digital industrialization in dental technology that is shaping and changing the future methods used in odontology: laser-melted implants, abutments, crowns, and bridges are ousting dental prostheses that are casted, shaped, and finished by hand.

Fresdental's strengths are its implants, which make up about 70% of revenue. The company documents and updates the valuable experience it gains in a specia lised database called the "Implant Library". Conventional processes are used for manufacturing, such as the production of dental prosthesis on 3-axis DSC milling machines, and CAD/CAM technologies, such as laser melting with metals, have been in place since 2005. As Francisco Perez Carrio, dental prosthetic technician at Fresdental, puts it, the two Mlab Cusing laser melting systems from Concept Laser based in Germany are an "expression of the increasing use of modern CAD/CAM technology in dental technology." In Spain, the CAD/CAM technology reached odontology early, says Perez Carrio. "Compared to the classic calculation of a manually oriented dental laboratory, digital manufacturing is extremely economical and even offers qualitative advantages." The price for manufacturing an average dental prosthesis is about EUR 20–and falls to just under EUR 10 when additive manufacturing is used. "Laser melting with metals is the logical expression of digitalization in manufacturing and can be used to achieve the highest quality standards." Therefore, it will not be possible to separate the digital future from laser melting.

Fresdental specia lised in very complex geometries early on. This new procedure that is not bound by a mold earns points, especially in designs with large spans or even in orthodontic implants that have to be embedded. "Dental technicians and dentist have new options in regard to fitting accuracy, geometry freedom, or more sophisticated clamps," explains the technician: basically it would be possible to create designs that would offer more

YOUR KEYWORDS

- Laser Cusing in dentistry
- All parameters can be influenced
- Combinations of module and multiple-component types
- Engineering of laser-melted components

Metal laser melting technology is used to make abutments, crowns, and bridges in a single step–on a shared base plate with supporting structures.

Photo: Fresdental

benefits to the patients who use them. The designs made by additive manufacturing are superior to conventionally manufactured dental prosthesis in performance and service life.

For instance, the additive structure allows for secure ceramic veneers, for example using innovative veneer ceramics. Surface blemishes in the molding process, such as cavities, do not occur during laser melting. Rapid manufacturing processes, such as laser melting, allow the laboratory to fall back on the best functional and economic solution for each dental prostheses according to the requirement.

Using powder to influence quality and precision

The material is selected on a case-by-case basis, says Francisco Perez Carrio. The trend is heading towards transparent and tooth-colored materials that have a variety of uses. The Laser Cusing process allows for the economical manufacturing of caps, bridge supports, model casting pieces, abutments, and primary and secondary parts made from powder. In addition to the machines, the alloy powder is very important for a high-quality prosthetic support: the composition, powder form, particle size, and particle size distribution determine the quality and precision of these manufactured parts.

”For us, it is important to be able to influence all process parameters in the construction process,” says Francisco Perez Carrio, ”only in this way can we define the geometry, as well as the thickness, rigidity, and elasticity or e-module of the final product and to manufacture it the way we want to.” Fresdental also offers combinations of types using modules and multiple components. Base bodies that will be implanted in the jaw are used as primary parts, and a superstructure made by additive manufacturing is attached to the base body; as a secondary part, the superstructure holds a ceramic veneer–made of Heraceram, for example–reliably and for a long time.

Adapted additive manufacturing technology can be used today as a single manufacturing step for making bridges that not only have more than ten elements without tension, but that also can be designed with reinforcement in areas under intense stress–such as in unsupported regions, in marginal zones, or for the elasticities of clamps. Model casting does not always provide an ideal solution in this regard.

Tension in design is reduced through thermal treatment. This also applies to tension that occurs when the blanks are used for cosmetic coating in the ceramic kilns. “There are many methods for reducing tension, even if the demand for training is not yet present,” adds Francisco Perez Carrio.

A continuous digital process chain is the next step in laser melting in dental technology. It is only logical that Fresdental is also focusing on intraoral scanners. The reason is simple: intraoral scanners that generate digital primary data in the dentist’s office can be used to generate digitally STL design data. The continuous digital process chain, from the patients all the way to the dental product, will accelerate data migration in a qualitative way that is less time consuming, predicts Perez Carrio. Intraoral scanners could soon become standard equipment in the dentist’s office. ■

Guido Radig
Technical journalist in Bergkirchen, Germany

www.concept-laser.de/en

Redesigning

At the end of 2014, Concept Laser GmbH, based in Lichtenfels, Germany, and RSC Engineering GmbH in Cologne entered into a strategic partnership for the designing of laser-melted components. References and expertise from RSC Engineering provide “an excellent basis for exploiting the strengths of Laser Cusing in the future,” states Frank Herzog, managing director of Concept Laser.

The partnership with its highly specialised design office follows a current market trend: when additive manufacturing designs had so far been asked to replace components made from moulding or milling processes, the designers and engineers recognized increasingly that additive production opens completely new approaches to engineering. “Laser-Cusing-based” engineering leads to bionic or lightweight construction approaches, creating components that have optimized geometries and that open new potentials in categories such as function and resilience. According to a statement from Concept Laser, RSC Engineering is “one of the design engineering pioneers that can already incorporate the strengths of laser melting with metals into component development.” This technology makes additional functions possible, explains RSC Engineering managing director Tim Richter, such as cooling, injection moulding of moving components in one shot without assembly, or lightweight structures that can withstand high stress with their lighter weight. Hybrid manufacturing solutions combine conventional processes with Laser Cusing. “The point is to understand the new possibilities and to implement them in a specific way. This is how you get past substitution to reach completely new solutions.“

Photo: Concept Laser

Instead of manufacturing an exhaust sensor as a welded structure, Laser Cusing can be used to make these sensors including all its channels optimized for flow technology in a single step. This lowers manufacturing costs by about 60%.