Additive manufacturing in dental prosthetics

Benefit from our system solutions for the economical production of dentures
Additive manufacturing in dental prosthetics
For additive manufacturing, the interaction between the system, the qualified material and the optimal process control guarantees high-quality components. As far as the manufacturing of dental restorations is concerned, EOS has perfected this interaction and validated it as manufacturing of medical devices.

Your advantage:
Reproducible quality with simultaneously optimal unit costs in the manufacturing of crowns and bridges. In addition to that, the fast construction process and the short setup times of our industrial 3D-print-systems lead to further time saving.

As proof for our EOS performance promise, there are more than 150 EOS systems worldwide which economically produce more than 7.5 million crowns and bridges in first-class quality every year.

Talk to us about your challenges.
EOS provides industry-specific concepts and technical solutions following the entire value chain:

→ Full traceability of the metal powders
→ Elaborate service concepts with global coverage
→ Dental-specific training by dental professionals

Further information on our products and services is available at: www.eos.info
EOS provides complete solutions from one source for starting in additive manufacturing of dentures as well as for extending your production capacity. Therefore, we provide full control over all processes relevant for quality and a real end-to-end-solution according to the highest possible standard (certification according to Annex 2 of the MDD 93/42/EEC).

Simple start, fast success

Two class IIa medical materials for dental applications (Directive 93/42/EEC):

- EOS CobaltChrome SP2
- EOS CobaltChrome RPD

Systems for DMLS® quality:

- EOS M 100
- EOSINT M 270

Processes:

- Extensively tested process parameters for dental applications

Trust in our perfectly coordinated and complete portfolio for the additive manufacturing of dentures.

Training and service:

- Dentistry-specific training for the fastest possible production of the already fully validated dental manufacturing chain
- Customer-specific service solutions

Software:

- Open selection of import data (STL): 3Shape, Dental Wings, Exocad ...

Benchmark of the EOS M 100: 74 units in 3.5 hours
Economical and precise: digital manufacturing of dentures

CAD-CAM additive vs. CAD-CAM subtractive

Nowadays, crowns, bridges and model casting with cobalt chromium alloys (class IIa, Directive 93/42/EEC) represent the basic supply of partial dentures worldwide. They are cost-effective and still fulfill high standards concerning precision, aesthetics and durability.

There is a choice between two contrary technologies for the production of dental restorations: CNC milling (subtractive process) and industrial 3D printing (additive process).

For the manufacturing of implant superstructures, the combination of subtractive and additive manufacturing processes is a highly economical manufacturing option. We would gladly give you advice on the optimal system configuration for you and your applications.

When comparing the overall costs, the advantage of additive manufacturing is evident:

→ Significantly more output with low material usage
→ No additional costs for tools
→ Fast and very versatile technology
→ Superior unit costs via additive manufacturing

Industrial 3D-printing allows for the manufacturing of individual geometries in large quantities at low unit costs – fast and without extra costs for tools.

CNC milling of crowns and bridges

DMLS® process for the additive manufacturing of dentures
The EOS production machines stand for innovative engineering Made in Germany and they apply the technology of Direct Metal Laser-Sintering (DMLS®).

EOS M 100
Fast and easy handling, high cost efficiency

The EOS production machines stand for innovative engineering Made in Germany and they apply the technology of Direct Metal Laser-Sintering (DMLS®).

Overview of the advantages of the solution:

→ Manufacturing capacity of crowns and bridges: Ø 75 units per building order
→ Efficient coating and exposure strategies
→ Modular inner structure and powder storage containers simplify and accelerate the setup and taking down
→ Homogeneous and dense structure of the material

With the system, crowns and bridges are produced fast and cost-efficiently from the CE-certified material EOS CobaltChrome SP2 (CE 0537).

Technical data EOS M 100

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable construction volume</td>
<td>Ø 100 mm x 95 mm (height, incl. construction platform)</td>
</tr>
<tr>
<td>Layer thickness</td>
<td>30 µm</td>
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<tr>
<td>Laser type</td>
<td>Yb-fibre laser, 200 W</td>
</tr>
<tr>
<td>Precision optics</td>
<td>F-theta lens, high-speed scanner</td>
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<tr>
<td>Scanning speed</td>
<td>up to 7.0 m/s</td>
</tr>
<tr>
<td>Focus diameter</td>
<td>40 µm</td>
</tr>
<tr>
<td>Measurements (w x d x h)</td>
<td>800 mm x 950 mm x 2250 mm</td>
</tr>
<tr>
<td>System</td>
<td></td>
</tr>
<tr>
<td>Recommended installation space</td>
<td>minimum 1.00 m x 3.00 m x 2.5 m</td>
</tr>
<tr>
<td>Weight</td>
<td>580 kg</td>
</tr>
</tbody>
</table>

Software
EOSPRINT, EOS RP Tools, Cambridge

Optional accessories
EOSSTATE laser, powder conveyor and screen module, wet separator, blast cabin
EOSINT M 270
Manufacturing large quantities, flexible application

The system accelerates the flawless manufacturing of model casting prostheses from the material EOS CobaltChrome RPD (CE 0537) and it can also be used for the large-scale production of crowns and bridges from the material EOS CobaltChrome SP2 (CE 0537).

Overview of the advantages of the solution:

- Manufacturing capacity of crowns and bridges: up to 450 units per building order
- Manufacturing capacity of model casting: up to 35-40 units per building order
- Homogeneous and dense structure of the material and constant tolerances
- Refined post-processing process leads to an especially high ductility of the brackets of the model casting prostheses

<table>
<thead>
<tr>
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<tr>
<td>Useable construction volume</td>
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</tbody>
</table>

Software
EOS RP Tools, Cambridge

Optional accessories
- Powder conveyor and screen module IPCM-M extra, wet separator, blast cabin
Only due to high-quality raw materials, the reliable manufacturing is possible. At our own R&D and manufacturing site for metal powders and processes in Turku (Finland), a team of more than 40 specialists ensures the superior quality of our materials. The quality assurance of each material batch begins with the testing of the chemical characteristics and particle size distribution and ends with the analysis of additively produced test specimens – for the best results possible during the later production by our client. This multidimensional quality management by our material and process development in Turku ensures the uniform condition of every batch.

The metal powders fulfill the necessary standards which are set for medical products. Testing and processing steps are conducted in clean room areas.

EOS CobaltChrome SP2: manufacturing crowns and bridges cost-effectively

- Biocompatible cobalt chromium molybdenum alloy (type 4 acc. to ISO 22674)
- CE-certified for usage in the dental industry (CE 0537)
- Further processing like cast frameworks

EOS CobaltChrome RPD: manufacturing accurately fitting partial dentures fast

- Biocompatible cobalt chromium molybdenum alloy (type 5 acc. to ISO 22674)
- CE-certified for usage in the dental industry (CE 0537)
- Further processing like cast model casting
Manufacturing dental implants requires the utmost precision. Narrow standard tolerances must be strictly adhered to, which cannot be currently achieved using industrial 3D printing processes alone. The efficient, economic solution is hybrid manufacturing – a combination of production technologies that apply and remove layers as needed.

The seamless combination of fast, economical 3D printing with the precision of conventional CAD/CAM solutions using CNC milling techniques enables us to incorporate the advantages of both production technologies. You are free to select the most suitable milling equipment. It enables you to produce superstructures with individual patient geometries at low unit cost, which would not be possible without hybrid production.

### Seamless, tested production process:

1. **3D patient data**
2. Data preparation of the denture, including implant geometries with measurements provided by partners such as Follow Me!
3. Transmission of the data in STL and milling paths "CAM interface"
4. Manufacturing of the preform on the EOS M 100
5. Final finishing process on a milling machine (such as from GF Mikron or Datron)
6. Remilled build platform after heat treatment

**Hybrid manufacturing:** Cost efficiency combined with outstanding precision
As the only company supplying additive manufacturing solutions, we provide a service for all performance and life stages of our products which is available worldwide. Therefore, the global EOS service organization maintains regional service centers with highly qualified staff in Europe, North America and the Asia-Pacific region. A growing number of local service points with their own stock of spare parts ensures the contact with our clients.

**Trainings**
In order to provide a long-term competitive advantage for our clients, EOS provides extensive dental training measures. These follow the entire process chain, from data processing over manufacturing to the post-processing of workpieces. In this way, we guarantee that our clients benefit as much as possible from our solutions – for a sustainably successful business model.

**Expert teams**
The EOS expert teams are there for our customers: Applications which solve customer-specific challenges are developed in an uncomplicated and fair way. The competent teams which are put together depending on demands refer to technical experts and dental technicians and provide comprehensive help for our clients on site as well as at the EOS headquarters and the branches.
The BEGO Bremer Goldschlägerei Wilh. Herbst GmbH & Co. KG is one of the leading dental companies worldwide. In their three business divisions BEGO Dental, BEGO Medical and BEGO Implant Systems, the owner-managed company provides a large variety of products and services “Made in Germany”.

Christoph Weiss, managing partner of the BEGO corporate group: “The amount of time spent on research and development by BEGO in the area of laser-sintering paid off – the tremendous benefits of the procedure in the area of dentistry are evident. EOS use our BEGO-patents and, due to their extensive technical know-how, they are a very attractive cooperation partner.”
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