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Tools for Medical Engineering

High-Precision Manufacturing of Titanium Jaw Plates

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Anybody looking to machine medical components cost-effectively and reliably needs high-precision tools that have been tested in practice — sometimes with the smallest of dimensions. The tool manufacturer Inovatools from Haunstetten near Kinding in Germany offers the Inomed range of tools for this very purpose.

<https://cdn1.vogel.de/unsafe/fit-in/1000x0/images.vogel.de/vogelonline/bdb/1802600/1802600/original.jpg>

Inomed tools from Inovatools are ideal for machining the kinds of materials required in medical engineering such as bone compression plates made from titanium.
(Source: Inovatools Eckerle & Ertel)

Thanks to optimized geometries, quality documented with test reports and outstanding service life, the Inomed tools are ideal for processing the kinds of materials required in medical engineering — stainless steels, zirconium oxides, titanium, cobalt/chrome and many more. One example is the production of bone compression plates for osteosynthesis in jaw surgery.

For implants, surgeons, orthopedic technicians and dentists mostly use specially alloyed surgical steels or highly bio-compatible titanium alloys. But these materials are extremely difficult to machine cost-effectively and in line with the relevant directives – for example,

medical components made from titanium with high elasticity and low thermal conductivity. This is because the high temperature of the cutting edge due to low heat dissipation through the chips and workpiece results in thermally induced stress in the tool. In addition, the high threshold load due to the lamellar chips combined with the high, localized pressure loads on the cutting edges due to the material hardness mean that conventional tools quickly reach their limits.

According to Nilüfer Cebic, Head of Product Management and Marketing at Inovatools miniaturization, precision and compliance with the most stringent of standards are decisive in medical engineering, which was something that tool manufacturers have to take into account and reflect in their product ranges. To cope with these hard-to-machine materials, development of the cutting edge geometries requires a sharp awareness of these factors coupled with the right combination of coatings and surface and edge preparation, Cebic argues. After all, only implant manufacturers that can rely on the quality of the very best tools available could perform machining processes cost-effectively and with maximum precision. Inovatools has 30 years of experience in the production and development of highly specialized tools for the medical sector. The company's portfolio offers a wide range of special tool concepts from premium standard line to application-optimized special solutions.

Express shipment of special tools

Due to the difficult-to-access geometries of bone compression plates for fractures in the jaw area, machining tools are often very narrow and usually designed with a long reach. To avoid vibrations caused by the long projection lengths and ensure cost-effective production, Inovatools matches the helix angle and cutter pitch of the tools to these special machining situations.

Norbert Geyer, Head of the Special Tools department at Inovatools explains that the range of Inomed mills makes tool selection quick and easy and opens up new options for high-precision milling in the micro range for diameters of between 0.1 mm and 20.0 mm. The manufacturer also develops and produces special tools for complex drilling and milling tasks with extreme precision and accuracy in the µ range. Thanks to our Special Tool Express Service, the manufacturer receives a quotation specially tailored to their requirements within just 24 hours. The solid carbide (SC) special mills and drills in dimensions from 0.1 mm to 32 mm,

which are custom-made for individual requirements including edge preparation and PVD coating, can then be shipped within just one week.

Real-life example: frictional connection

The bone compression plates used in jaw surgery are titanium implants available in different thicknesses and designs. Due to the stringent requirements imposed on the material, application-optimized tools are absolutely essential for machining. The tendency toward sudden strain hardening, for example, can instantly increase the friction on the cutting edge, causing the tool to become blunt. The combination of carefully selected, ultra-fine-grain carbide, the perfect geometry and chip control, prepared cutting edges and high-performance coatings is the key to commercial success and consistently high quality.

During the machining of bone compression plates to create frictional connections, the Inovatools tools demonstrate far superior process reliability and performance in a range of representative applications compared with conventional tools. Taking the jaw plate as an example, the challenge was to increase throughput without compromising process reliability. The tool was optimized with special surface treatment, edge preparation and internal cooling. The resulting special mill makes the milling process 40 % faster with Vc = 70 m/min; F = 700 mm/min. With a second special fiber end mill, the upper and lower outer edges of the jaw plate are chamfered simultaneously (Vc = 60 m/min; F = 225 mm/min), reducing the machining time by 50 %. With a special Inovatools combination tool for drilling and chamfering, implant manufacturers can achieve time savings of more than 60 % compared with conventional production using two tools, the company claims.

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(Picture: Inovatools Eckerle & Ertel)

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(Picture: Inovatools Eckerle & Ertel)

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Nilüfer Cebic, head of Product Management and Marketing at Inovatools: "Miniaturization, precision and compliance with the most stringent of standards are decisive in medical engineering, which is something that tool manufacturers have to take into account and reflect in their product ranges." **4/5**
(Picture: Inovatools Eckerle & Ertel)

Norbert Geyer, head of the Special Tools department at Inovatools: "The range of Inovatools Inomed mills sets new standards in terms of performance, quality and integrity. It makes tool selection quick and easy and opens up new options for high-precision milling in the micro range for diameters of between 0.1 mm and 20.0 mm." **5/5**
(Picture: Inovatools Eckerle & Ertel)