Delivering high-precision deep drilling machines for the medical instrument cluster

Baden-Württemberg is one of the leading locations in Germany for the highest quality of machine tools. The federal state has established a fantastic position in the area of medical instruments, and, like Swabian machine tools, has a reputation that extends well beyond the state borders. Tuttlingen in particular continues to enjoy respect as the global centre for medical instruments, and first made a name for itself in the production of medical devices as early as the 19th century. Several hundred companies work in Europe's largest medical instrument cluster on innovative products for the medical industry.

One category of such instruments deals with traumatology or, more specifically, the products used for the treatment of bone fractures such as bone nails and screws. When fractures occur in hip joints and in the upper and lower extremities, bone screws may be used to compress the fragments and lock implanted intramedullary nails. These nails usually have two transverse bores by means of which the nail is secured with two screws against dislocation.

Why do bone screws require deep drilling?

When a bone fracture must be fixed with plates, nails, or screws, a so-called guide wire is positioned in the bone at the point in question. This wire is used to push the bone screw with the deep bore, guiding it safely to the bone so that the orientation of the fracture compression can be precisely ensured by screwing in the screws.

TIBO Tiefbohrtechnik GmbH, based in the Swabian town of Pfullingen, established itself on the high-precision deep-drilling machine market years ago and is familiar with the high standards of quality in the medical instruments industry.

Benjamin Röcker, TIBO's sales manager, says: "We know all about the requirements of quality and precision in medical instruments and have no problem meeting our clients' demands because we use precision parts in our deep-drilling machines. We simply do not have any oversized machines, they are expensive, and their performance potential is far above what is necessary. At TIBO, the modular design essentially means that each deep-drilling machine is tailor-made, just like a tailored suit."

One of the leading manufacturers of bone nails and screws from the Tuttlingen medical instrument cluster has found a competent partner in TIBO for designing its process. As TIBO has built and delivered deep-drilling machines for other applications for this client in the past, it was clear that TIBO would be a competent partner for the bone screws that were to be planned, one who could offer a package solution and whose machines could fit into the compact on-site spaces.

The framework conditions were a bore diameter of 2.5-5 mm with a drill path of 0.06 mm for up to 160 mm drill depth in titanium alloys (Ti6Al4V) and implant steel 1.4441. Solid carbide drills were used, in which the drill head and drill shaft are manufactured from a carbide blank. This

increases the tool's rigidity and reduces the drill centring and any torsion fluctuation. The clamping sleeves that are soldered to the drill shaft transfer the torque from the machine to the tool. A high concentricity between the drill shaft and the clamping sleeve reduces additional vibrations and improves cutting capacity and process safety. Because deep drilling is the last machining level in the manufacturing process and the bone screws therefore already have their outer geometry, workpiece machining and sealing of filigree screw threads and screw heads that have already been slitted are given special attention, so that the process returns reliable results with steplessly variable tensioning forces, coolant pressures of more than 160 bar, and solid carbide tools.

TIBO designers came up with a compelling tensioning concept. Because the wall thicknesses between the bores and the outer contour were as small as 2 mm in places and the screw thread and screw-in geometries differed greatly, special clamping sleeves that could be easily inserted into the deep-drilling machine's basic universal holders were constructed.

The E10 series deep-drilling machine, selected from TIBO's modular system, with its vertical supply magazine for a total of 80 workpieces and gantry gripper for loading and unloading the deep-drilling stations, was able to fulfil these requirements.

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