Customer Case Study at Altatec GmbH

High-end metrology for dental implants

X-ray tomography and 3D multi-sensor coordinate metrology

Medical technology products are subject to very high quality requirements. To ensure that these are met, ALTATEC GmbH, a leading manufacturer of dental implants in Germany, uses high-quality equipment from Werth Messtechnik both in the laboratory and in production: Scope Check and Video Check 3D multi-sensor coordinate measuring machines with rotary axis and a Tomo Scope XS, a powerful, compact computed tomography machine.

Treatment with dental implants has been scientifically recognized by the German Society of Dentistry and Oral Medicine (DGZMK) since 1982 and is now standard therapy in surgical practice. In Germany alone, more than 1.4 million implants are placed each year (source: DIMDC Report 2019). One of the leading dental implant manufacturers in Germany is ALTATEC GmbH, which is part of the globally active BioHorizons Camlog Group, a division of Henry Schein. The German Camlog company is based in Wimsheim near Stuttgart. As an exclusive manufacturer, the company offers the dental implant systems CAMLOG® , CONELOG® , CERALOG® and iSy®.

Altatec relies on state-of-the-art equipment to meet the high requirements of these medical technology products. This applies to both production and quality assurance for implants, abutments, accessories, and dental instruments made of titanium, titanium alloys, stainless steels, and ceramics. Ute Hätinger, team leader for materials and special testing, explains: „We monitor the quality of our products throughout all stages of production. This ensures that our end products meet all the necessary standards, such as CE and FDA.“ To this end, Altatec has state-of-the-art 3D multi-sensor systems coordinate measuring machines and, most recently, an industrial X-ray tomography machine.

„We are talking about shape and position tolerances that are sometimes less than 0.02 mm, for example in circular run-out and symmetries,“ explains Ute Hätinger. ®“This is particularly important for the tube-in-tube implant-abutment connection. Its geometric groove-cam principle enables almost perfect force and moment distribution, but only if high precision is guaranteed.“

The basis: 3D multisensor coordinate measuring machines

Altatec has long relied on high-performance metrology to verify this. Ute Hätinger, a graduate engineer in materials science and surface engineering, recalls: „When I joined Altatec 15 years ago, we already had a modern multisensor coordinate measuring machine from Werth Messtechnik, a Video Check IP with integrated rotary axis. The machine is very accurate and, thanks to its image processing sensor, probe and rotary axis, is capable of capturing a wide range of geometries. My job was initially to program the measuring machine for our applications.“

Ute Hätinger, graduate engineer and team leader for materials and special testing, at the Tomo Scope XS computed tomography coordinate measuring machine

A task that Markus Erhardt took on ten years ago. The trained toolmaker, who has been working in the Metrology Department since 2000, describes himself as a fan of Werth measuring machines: „They have accompanied me throughout my entire career as a metrologist. With the rotary axis on the Video Check, I can measure the workpiece on all sides in the same coordinate system.“ „We have repeatedly upgraded the machine with the latest hardware and software and have now also added a scanning probe,“ emphasizes Markus Erhardt, „so that it still meets all requirements today. The measuring machine is still highly accurate, extremely robust, and stable over the long term. This is where the unique guideway system of the X-Y stage with needle bearings and magnetic preload shows its strengths.“

He highlights the offline programmability of the measuring machine as a major strength, which saves a lot of time: „Firstly, the measuring machine itself is not occupied by teaching new components. Secondly, I can adapt the measuring programs to variants very quickly.“ There are numerous variants, as the implants are available in many different lengths and diameters. The abutments also differ, especially in the geometry of the head. This is a precisely manufactured tool blank, the geometry of which is individually ground by the dental technician according to the crown to be fitted.

The cross-sectional image shows the tube-in-tube® implant-abutment connection, which requires high precision. Image: Camlog

In addition to the implants and abutments, Markus Erhardt measures the tools required for implementation. These are various drills and thread cutters that the dentist uses to prepare the jawbone before inserting the implant. „Both the rotary axis and variant programming are essential for this,“ says the metrology engineer. Especially since the number of different drills is constantly increasing. „Ten years ago, there were about ten product families, now there are about 25. And each family includes 20 drills. If we had to completely reprogram for each tool, our measuring machine would be permanently blocked.“

The ideal addition: a computed tomography machine

But even so, over time, the capacity of the Werth Video

Check at Altatec reached its limits. Ute Hätinger and her metrology team therefore looked around for a supplement. When they wanted to request a quote for another Video Check machine from Werth Messtechnik, they noticed the newly developed Tomo Scope XS, a highly accurate and compact computed tomography coordinate measuring machine. „We had already looked into this technology a few years ago and considered it relevant,“ says the team leader. „But the machines available at the time were too large, their measuring accuracy too low, and they were expensive. That has changed with the Werth Tomo Scope XS. The exemplary transmission tube in an open monoblock design achieves a small focal spot even at high tube power, enabling fast measurements with high resolution. In addition, the new possibilities of computed tomography create great added value.“

These arguments convinced the Altatec team. A Werth Tomo Scope XS has been in the laboratory since 2019. Despite its high performance, it requires very little space and, thanks to its low weight, can be set up almost anywhere. The metrology engineers placed an offline workstation right next to it to evaluate the captured data.

„We use computed tomography for incoming goods inspection of plastic parts, for example,“ explains Markus Erhardt. These include complex packaging elements for implants, where many geometrical characteristics have to be measured. The measurement on the Video Check took a correspondingly long time. The effort required to measure 16 parts was around 180 minutes. „With the Tomo Scope, we can now scan four features at a time,“ says Erhardt, describing the new procedure. „The stored point cloud is a complete digital image of the workpieces and can then be evaluated offline in parallel with the next measurement. This means that we now only need 30 minutes for the 16 parts.“

Whether implants, abutments or tools – the Werth Video Check coordinate measuring machine ensures high-precision measurement results at Altatec

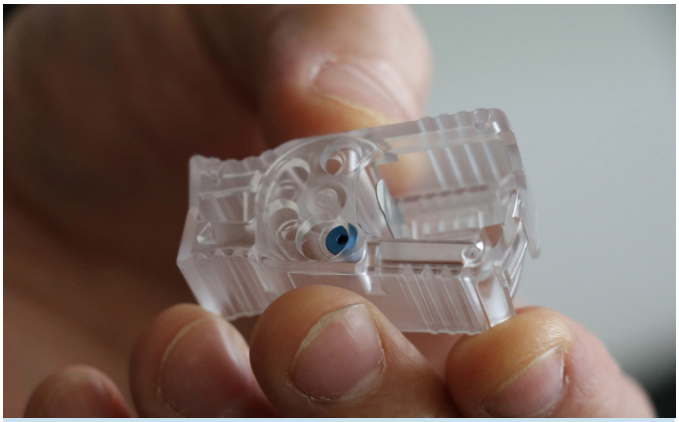
Altatec achieves similar savings with implant holders, closure caps, and multifunctional caps. Titanium and ceramic implants are now also measured on the Tomo Scope. „We achieve accuracies that ensure optimum results,“ confirms Markus Erhardt. To be sure of this, Altatec went to great lengths, comparing the measurement results of the Tomo Scope with those of the Video Check and even having reference measurements carried out. The result: the differences were a maximum of 2 µm to 3 µm. „This is proof of excellent quality,“ explains Erhardt. „In addition, we can always count on the support of the Werth application specialists if we have questions about special measurements, such as locating a thread runout.“

Ute Hätinger points out that it is not only the time savings mentioned above that contribute to the satisfaction of the metrology engineers: „ We generate added value through additional information, especially for assemblies such as the implant-abutment connection. With computed tomography, we can see exactly how the parts are positioned. In the past, we had to go to great lengths to produce ground images.“

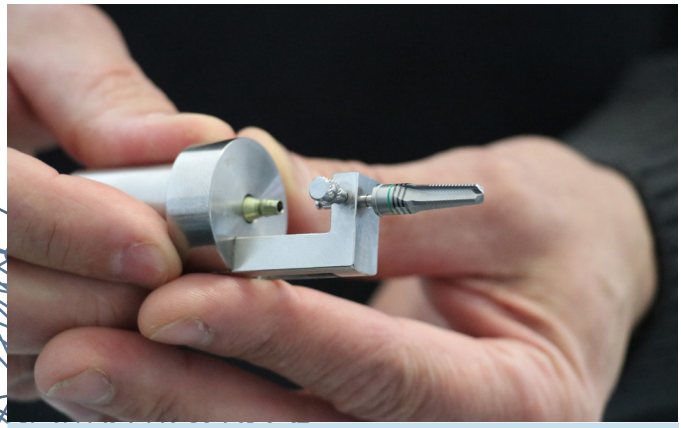
High-precision measurement in the production environment

Whether video check or Tomo Scope – Altatec feels well supported by Werth Messtechnik. But according to Ute Hätinger, requirements are increasing not only in the laboratory, but also in the production department: „We are increasingly being asked to measure special, high-precision implants and abutments with tolerances of less than 0.01 mm both internally and externally in close proximity to production. To do this, we also need coordinate measuring machines with a rotary axis that can guarantee this.“

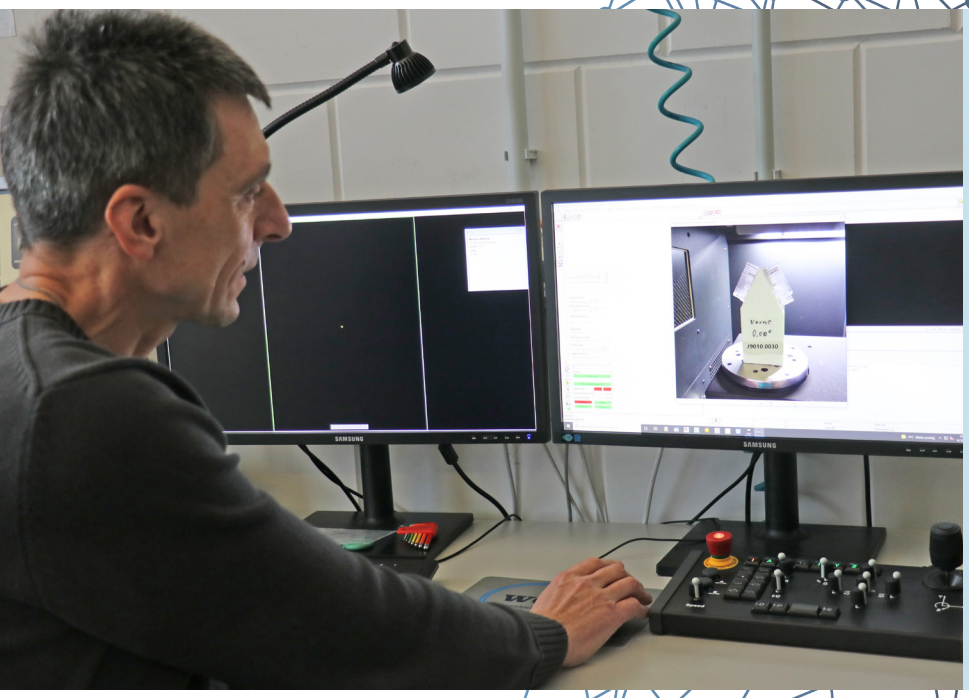
It was not always possible to switch to the laboratory, as some of these measurements have to be carried out every hour. The decision was therefore made to invest in two additional Werth Scope Check S measuring machines in 2021, which are optimized for use in production environments thanks to their extremely robust granite construction and protected guideways and scales.



These holders for implants can be measured with the Tomo Scope XS in a fraction of the time that was previously required.



Bone drills are measured on the Werth Video Check. The tool geometry requires a rotary axis for the measurement process.



Metrology technician Markus Erhardt starts a measurement on the Tomo Scope XS. An offline workstation is available for programming and evaluating the measurements.