Like many fields in dentistry, implantology has been transformed by technological innovations since its humble beginnings more than half a century ago. As the aesthetic and osseointegration properties of implant materials have continued to improve, the number of dental patients opting for implants has risen steadily. With this increase in procedures has come a demand foratraumatic and safe surgery with fewer postsurgical complications. Since 2005, French company ACTEON has established itself as a leader in digital medical imaging and high-frequency ultrasonic devices. Supported by its excellent clinical results, ACTEON continues to push the boundaries of what is possible in implantology as it seeks to provide products that optimise both the patient’s and the dentist’s experience.

ACTEON granted Dental Tribune International an exclusive look behind the scenes of its 3,200 m² manufacturing plant in Milan, where many of the company’s intraoral and extraoral imaging devices are produced. The team was proud to introduce its flagship model: X-Mind trium. This extraoral radiographic unit was first introduced at the International Dental Show (IDS) in 2015 and received a major update just in time for the 2017 fair. It offers a complete range of innovative solutions for diagnosis and treatment planning. Considerable attention has been paid to image quality and homogeneity, including X-ray emission, processing, stability and geometry. “X-Mind trium combines CBCT, panoramic and cephalometric imaging, which is why it is called a three-in-one device,” explained Claudio Giani, director of imaging research and development at the Milan site. He demonstrated that CBCT imaging. These teams work very closely together and production processes are highly controlled owing to their geographical proximity. This is further enhanced through collaboration with international dental surgeons, leading to the manufacture of devices that, according to ACTEON, deliver the best results for patients through minimally invasive and less traumatic treatments.
imaging is accomplished using a rotating gantry with a fixed X-ray source and a detector. Giani told us that, during the rotation, multiple sequential projection images, ranging from 150 to 450, are acquired to complete the arc. This procedure varies from a conventional medical CT scan, which uses a fan-shaped X-ray beam in a helical progression to acquire individual image slices of the field of view (FOV) and then stacks the slices to obtain a 3-D representation.

When we first approached X-Mind trium, we noticed right away the distinctive ergonomics of the radiographic unit. The device has an extremely short U-arm, which moves around the patient during the image acquisition phase. This is supported by the patented kinematics and collimation and aids comfortable positioning of the patient’s jaw. The entire system is designed with ergonomic efficiency in mind and takes up very little space in the practice room. With a secondary collimator (X-ray tube assembly) installed, the patient is not exposed to additional collimator movements.

**Excellent quality assurance**

ACTEON produces high-end quality products that undergo a tried-and-tested quality control process. “The production of X-Mind trium has risen month after month, especially since we obtained U.S. Food and Drug Administration approval and then launched X-Mind trium in the US,” stated Alvise Reither, the Milan factory manager. He explained that, by changing the factory’s layout and the flow of materials, new workflow processes were established. The manufacturing plant is continuously expanding, and with additional operators, it is able to meet the demands of the market. “In this factory, we use the Kanban approach principle, which means that we produce on stock, but finalise the product based on order. This way, we can balance demand with available capacity,” added Reither.

Moreover, ACTEON applies significant quality controls during all processes, from the assembly of the core of the machine to final testing, which includes checking of the components and the configuration of the workstation. According to the factory manager, this procedure has been streamlined significantly in comparison to last year. Reither showed us a large number of testing cabinets containing devices being checked. With complete concentration, employees in front of computers verify the correctness of every step before the X-Mind trium units are distributed. It is in this context that a large quantity of X-Mind trium devices are manufactured, tested and shipped each week.

“We have an excellent product quality. We want to ensure a high-quality standard, so employees take turns at the workstations. We also want to make sure that each employee knows and understands all the processes leading up to the finalisation of the product, establishing an appreciation of the importance of each step in the assembly. We further want our employees to respect ACTEON’s standard of quality. This follows the two steps of the quality control: (1) checking that all cables and parts are well assembled and (2) testing the machine’s functionality in the testing cabinets. Our quality manager also inspects the components when they are sent to us and before we put them into stock. No parts are assembled externally. A mix of components, cables, mechanical parts, motors and sensors are assembled by hand. That is also part of our quality management,” Reither detailed.
Sharp images

Excellent image quality is essential for treatment planning and diagnosis. In CBCT, exposure is incorporated in the FOV. This means that only one rotational sequence of the gantry is necessary to acquire enough data for image reconstruction. "In implantology, a CBCT image is indispensable for planning simulation and determining the exact nerve location. With only one image, the entire dental arch can be visualised, which allows for optimal diagnostic planning possibilities. X-Mind trium has a range of FOV options displayed in detail and without movement artefacts. He emphasised that the exposure time is very low and the reconstruction time is three seconds. We saw that, with a cephalometric image, the entire maxillofacial area is shown, making it highly suitable for oral and maxillofacial surgeons. Furthermore, it has a small voxel size of only 75 µm and a fast reconstruction time of 29 seconds. X-Mind trium can be equipped with one or two sensors for an efficient workflow.

With ACTEON’s expertise in medical imaging, a dedicated analytical algorithm has been implemented for X-Mind trium. “We have achieved exceptional results, which are able to provide advanced clinical indicators that will be helpful for practitioners in the future,” stated Giani proudly. “The analytical algorithm has been developed in terms of the graphics processing unit (GPU) and a specific type of GPU is installed inside the workstation of X-Mind trium when the CBCT function is configured,” explained Giani.

This algorithm is used to determine the apparent image definition and bone density to facilitate clinical decision-making. The filters ensure detailed recording of the image acquisition by low-noise micro-stepping motors.

Low radiation dose

With X-Mind trium, high radiation exposure is a thing of the past. The low-radiation protocol decreases the required amount of X-ray emissions by a third using the algebraic reconstruction technique. This means that the radiation dose for the patient can be reduced by 50 to 70 per cent. This low-dose imaging guarantees a maximum FOV with minimal radiation exposure to the patient. “This is essential because we do not care only about good images but also about the well-being of the patients,” stated Reither. Furthermore, the software of X-Mind trium monitors radiation and ensures that the levels of exposure are kept low.

User-friendly software

Computer scientists would say the software is as important as the hardware. ACTEON provides intuitive and ergonomic imaging software that has all the required functions—scanning, measuring, editing, commenting. In the factory cellar, Reither explained the special features of the ACTEON Imaging Suite software and stated that it can be linked to most practice management software and all ACTEON imaging products, such as the X-Mind trium, CBCT and panoramic devices, and intraoral scanners. It is compatible with both macOS (and soon iOS) and Windows and has a TWAIN driver for full compatibility with all imaging software. This gives practitioners the ability to move around and interact directly with their patients.

The radiographic unit is in continual operation at most dental practices. It is clearly imperative then to ensure that dental professionals have the skills to adequately handle the devices and take high-quality
images with the correct settings. "The user-friendly software enables the customer to either use the workstation provided or use their own. However, with the workstation provided, our professional and efficient team of service technicians can perform remote connections to solve problems of configuration or calibration. We want our customers to choose the software option that is best for them," explained Reither.

**Safe surgery**

X-Mind trium offers extraordinary functionality in the field of implantology, making it suitable for more demanding treatments. Misleading or insufficient information obtained from a radiograph can lead to the loss of an implant, one of the worst scenarios for both the patient and the dentist. "In pre-implant procedures, accurate measurements of the bone density and volume are essential to guarantee a higher success rate in implantology. The 3-D capability of X-Mind trium also facilitates safer osseointegration," said Giani. Clinical decision-making has seemingly become easier than ever with X-Mind trium.

Certainly, our tour would not have been complete without a look at ACTEON's well-known Piezotome ultrasonic brand. Thousands of dentists worldwide have adopted the company's celebrated Piezotome devices as their choice for pre-implant surgery, with Piezotome Cube representing ACTEON's new standard. It is a powerful ultrasonic device with a rotary motor, as well as a handpiece and a tip, ensuring optimum performance. Leading oral surgeon and implantologist Dr Angelo Trödhan successfully uses Piezotome Cube in his everyday treatment procedures. "The Piezotome's ergonomics makes the device naturally intuitive and reliable. Furthermore, it enables surgeons with less experience to perform a variety of treatments. In accordance with the cutting selectivity, soft tissue (membranes and nerves) is preserved. During piezoelectric surgery, fine and precise cuts minimise bone loss. In 98 per cent of cases, patients do not need to use analgesics post-operatively and barely any swelling is observed. Surgery with Piezotome Cube maintains the patient's quality of life," said Trödhan.

In implantology, bone grafting materials may be necessary for the implant to succeed. For this reason, QUALIOS was developed, and it was first introduced at IDS 2017. The material has a unique bone-supporting structure and high level of mechanical resistance. Its large interconnected pores make it particularly suited to bone colonisation, and it is completely resorbable, ensuring high-quality bone regeneration. Being entirely synthetic, it is free of any contamination risk that comes with products of animal or human origin. It is clear from this that QUALIOS complements ACTEON's implantology product line.

In ACTEON's continuous product expansion, patients' well-being continues to be the top priority. We felt the passion employees put into their daily work to support ACTEON's innovative portfolio for imaging and piezoelectric surgery. These products have positioned the company as a pioneer in oral surgery and dentistry. They are less invasive, safer and faster to operate, and provide patients and practitioners with the best treatment options available.