AMERICAN SOCIETY OF MECHANICAL ENGINEERS HONG KONG SECTION TECHNICAL VISIT TO KOLN 3D MANUFACTURING LIMITED ON 24/1/2026

ASME Hong Kong Section visited KOLN3D on 24/1/2026

Three dimensional ("3D") printing is no longer novel in technology, but has been manufacturing components for wide range of industrial applications. Even orthopaedic and maxillofacial implants can be 3D-printed, and custom-made 3D-printed implants ensures suitability to patients with higher precision and effectively shortens surgery duration; thus lower the chance of wound infection. Hong Kong has solutions on improving implantations, represented by Koln 3D Manufacturing Limited ("KOLN3D").

Established in 2016, KOLN3D is Hong Kong first custom-made implants provider. Its 3D-printed implants from head to toe have found successful applications in Hong Kong, Thailand, Singapore, Kazakhstan and France. It also 3D prints surgery tools in sizes more suitable for Chinese surgeons to use. Comparing its western counterparts, such as Johnson & Johnson, KOLN3D can provide 3D-printed implants in one-third of their price, making orthopaedic implantation more accessible to the population. Moreover, the KOLN3D produced new implants can provide replacement of the plastic implants already in the patient's body and worn-out. The metal implants are more durable than the plastic ones, improving the patients' life.

3D-printed implants start from the inputs from computed tomography ("CT") images scanned on the patient. The CT images are then converted into a 3D file, which is the basis of creating an electronic model for execution by a 3D printer. Though currently converting CT images into a 3D files is the most time-consuming step in 3D implants production, the time is under reduction, leveraging the use of artificial intelligence ("AI"). KOLN3D is partnering with Hong Kong University of Science and Technology ("HKUST") in the development of AI to convert images from three radiographing films into a 3D file. HKUST provides the AI technologies, while in parallel KOLN3D is soliciting local medical institutions to provide clinical data to train the AI model, so that the AI model is accurate and efficient in creating the 3D model.

KOLN3D success started in the year of its establishment. It was approached by a surgeon in Hong Kong, who was exploring 3D printing to custom-make an ankle for his patient in a heavy traffic accident. Using 3D-printed metal implants was innovative at the time; in fact that ankle

implantation using 3D-printed metal parts was the first of its kind in the world. KOLN3D had no precedence to make reference to.

The first criterion was medical-grade 3D printing powders, tested according to ASTM standards, were used to produce the implant. The second criterion was the establishment of the acceptance criteria, which was initially challenging. The first challenge was there had been no codified standard to govern the final product's tolerances. Orthopaedics had little concept about precision on the implant's dimensions at the time. Therefore, when asked about the needed tolerances, the surgeon provided no exact requirement, and KOLN3D had to invent them itself.

Fortunately, KOLN3D learnt that CT scans had accuracy of 0.635 mm, and the 3D printers in its fleet could print up to 0.5 mm in dimensional differences. It could be convinced that its 3D printers could print implants no less than the CT scan results in accuracy; thus 0.5 mm was agreed to be the tolerance limit.

The next challenge was smoothness. Again there was no code that governed implants in their surface average roughness, in Ra. In fact, even health administrations and standard setters in overseas jurisdictions, such as Food and Drug Administration in the U.S. and CE in European Union, provide only guidelines on the performances of orthopaedic implants, on the basis of every medical case is unique. It is the surgeon that decides the requirements of the implants. KOLN3D resolved this with offering three samples of smoothness for the surgeon to choose.

3D-printed chest bone orthopedic implant with ends in socket for positioning

The result was that the patient recovered 50 % of functionality, a milestone for orthopaedic implantation. Experiences were gained, and more cases followed. Recently, a patient of chest bone cancer has received implantation, with the 3D-printed titanium implant fits in position by sockets. Though the implant weights up to three times of the bone it replaces, the muscle around the implant would develop to take-up and balance the extra weight, so that the patient would have perceived little difference in weight eventually.

With the experiences gained, now the implants for static applications are 3D-printed of titanium alloy, while the implants for movements are of chromium cobalt alloy. Moreover, the bone plates can be designed to carry the function of containing medicine and discharging it, often antibiotics, to the interfaces to avoid from inflammation.

KONL3D has multiple industrial-sized 3D-printers from Japan and Switzerland. The Japan-made units are integrated with computer numerical control machine, so that the 3D-printed work piece can be completed without machining elsewhere. They use argon gas to shield air from the printing surface and exposure to dust in the atmosphere. The Swiss-build facilities are

specialised in printing titanium-based parts under vacuum. The 3D-printed implants are baked in an oven to relief internal stresses and then subject to 3D scanning to verify dimensions, before dispatching to the surgeon's hands, where they are put into patient's body after medical disinfection.

KOLN3D exhibits how engineering can tangibly improve people's lives in medical environments. It is also a story of successful entrepreneurship. The founder invented KOLN3D when he had had an established career in his preceding job. He challenged himself under inspiration by his Christian pastor, and changed course of his career with starting his 3D-printing business from scratch. KOLN3D is backed by research fundings from the local government and Hong Kong Science and Technology Park, the major incumbent of innovative technologies, as well as leading edge knowledge and valuable proprietary data from the universities in Hong Kong. They provide the eco-system for KOLN3D and other high-tech companies in Hong Kong to nurture and mature. Though there are many more similar success cases, KOLN3D is indeed worth recognition.

ASME Hong Kong Section Chairman (2025-26), Mr. Alex Ho, presented souvenir to KOLN3D founder and CEO, Mr. Edmond Yau, in appreciation of offer of technical visit

ASME Hong Kong Section thanks Mr. Edmond Yau, KOLN3D founder and Chief Executive Officer, for his hospitality in opening KOLN3D for technical visit on 24 January 2026.

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