

TRADITION AND INNOVATION:

A feeling for sharpening and a tool for life created in a new way

TAKAYAMA Instrument, Inc.,

With a 90% share of the domestic microsurgical scissors market in Japan, TAKAYAMA Instrument is located on a corner in the Yanaka area near downtown Tokyo. The company developed and optimized a forging technique over many years which is used to make the concave-shaped blade of its microsurgical scissors and scrape the sharp cutting-edge to a 1.5 to 2 mm long tip at the end. Kuniko

Yagura from Leica Microsystems visited with Mr. Ryushi Takayama at the company's factory in Tokyo and asked him about the sophisticated techniques and skills needed for the manufacturing of microsurgical scissors and how optical microscopes are used.

Surgical instruments still made in the Yanaka residential area of Tokyo

The manufacturing site is integrated with a house on the same premises. There is no sign indicating where it is, so it is possible to get a bit lost when looking for a factory.

"Everyone hears the sound of processing and polishing machinery here", said Mr. Takayama. "This is what the company relies on. It has a long history, where its founding dates back to 1905. It has long worked on the production of surgical instruments and its main products today are microsurgical scissors for neurological operations on the brain and nervous system.

Neurosurgical procedures require particularly demanding, advanced skills and rigorously developed surgical instruments. Although medical scissor design is always evolving, these surgical tools are still fundamentally unchanged from their early beginnings and are still in use today by all neurosurgeons. Currently these surgical scissors are widely used not only in Japan, but all over the world."

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A beautiful scissors-like “Naginata” (Japanese pole blade)

Mr. Takayama gave a brief description of his microsurgical scissors, “The essential instrument for neurosurgery is a pair of microscissors with a 10 mm long shear edge blade. The fine cutting and peeling which occurs during neurosurgery must be performed under a microscope. The working space is tight, the tissue is fragile and weak, and fine blood vessels have to be stretched, so sharp edge cuts will be required to remove the targeted tissue.



Fig. 1: A pair of “Muramasa” microscissors from the Kamiyama series of instruments offered by TAKAYAMA Instrument.

The microscissors were developed under the guidance of Dr. Hiroyasu Kamiyama who is the pioneer of cerebral bypass surgery in Japan and is admired for his surgical skill. In his honor, the

set of microscissors for neurosurgery offered by TAKAYAMA Instrument is called the “Kamiyama series”. The blades of the microscissors have a shape very similar to a “Naginata”, a Japanese pole blade, or a “Muramasa”, a Japanese sword.

Originally Japan’s blacksmith technology was developed to produce swords, armor, cutlery, and later firearms from iron. When western medicine was introduced to Japan at the end of the Edo period (1868), surgical instruments began to be made with the same blacksmith technology used for swords, armor, and cutlery. Swords like the samurai’s “Katana” in Japan are not merely regarded as weapons, but cultural assets. The same is true for surgical instruments, such as scalpels and scissors. A sharpening method was developed called “dent shape” which is used to make a Naginata-shaped blade with an extremely sharp edge and fine tip. Historically, this polishing technique was handed down from craftsman to craftsman over generations to create surgical instruments for surgeons and, at present, this historic, time-honored skill survives only within our company.”

The structure and overall design of the microscissors is exquisite. When observing them, you do not get the impression of an inanimate surgical instrument. The microscissors are very basic tools, but also a work of art that allows the surgeon to operate with comfort whenever in use at the clinical workplace.

What is expected of surgical instruments?

“It is difficult to use either mass or just-in-time production methods to manufacture all varieties of surgical instruments with the same quality”, Mr. Takayama mentioned. “Just-in-time, low-volume, production is exploited currently for the 5th generation of Kamiyama series microsurgical instruments. A knowledge of anatomy and

surgical technique is essential to understand the everyday needs and functions of neurosurgeons. One of the major challenges for professional surgeons is keeping up with the continuous evolution of know-how and technology. So it is important to understand that our instruments must also evolve to satisfy their needs.”

The microscope is an important partner for "quality control" and "inspection"



Fig. 2: Ryushi Takayama using a S8 APO (left) and one of his employees, Uchikoshi, using an A60 F (right) stereo microscope to inspect a surgical instrument component. Both microscopes from Leica Microsystems are used for inspection and quality control at TAKAYAMA Instrument.

Mr. Takayama further described how microscopes are helpful tools for surgical instrument manufacturing, "Microscopes are essential for all quality inspection work, including pre-shipment. Currently, all microscopes used by TAKAYAMA Instrument are from Leica Microsystems. They allow a detailed observation of the sample with a large field of view, high depth of focus, and versatile illumination. Being able to zoom-in on details is also important.

These microscope features are necessary for high quality inspection which requires microscopic observation to check the instrument part with precision and the ability to complete it in a short time. With a smaller field of view, the user has to move the

sample many times and time is quickly wasted. If the image of the sample is not clear during inspection, this can lead to a deterioration in instrument quality.

The S8 APO stereo microscope supplied by Leica Microsystems fulfills all these requirements. Quality inspection is easily done also with the A60 F stereo microscope from Leica Microsystems. High performance accessories, such as the swing arm or flex-arm stand which allows the microscope to have more freedom of movement, making the price versus the performance of these Leica microscopes very attractive. TAKAYAMA Instrument has multiple S8 APO and A60 F stereo microscopes being used in the factory."

Both analog and digital technology used

At first sight, it is easy to have the impression that craftsmen with decades of experience in this field of expertise produce each surgical instrument, but all the workers in the factory are young people in their 20s and 30s. Moreover, it was surprising to see that there are lots of women working there.]

Mr. Takayama explained, "Yes, there are a lot of young people. Of course, at the end of production we finish the polishing manually, so skilled craftsmanship is necessary. For example, the ability to recognize the specific grinding sound which indicates that a good polishing has been reached requires years of training and experience.

However, even to the extent that we use automated machines at earlier stages in the production process, it is still important to judge accurately manual machining work. We have established the production method with machining tools by drawing from the experience gained by trial and error in the very early days of surgical instrument production. Today, 3D CAD (computer aided design) is used with the machining tools for continuous and simultaneous 5-axis control. So not only a sense of analog, but also of digital technology is needed, therefore young people fit in well here working in the factory with the current production process.

Manufacturing of surgical instruments begins with finding the right materials and machining tools. We are looking for good ones all around the world, whether made in Japan or elsewhere. We procure good materials and tools from wherever, once we find them. If you do not use cutting-edge technology today, a world-leading surgical instrument company cannot win against the competition. If the machine breaks down, then in-house repairs must be done to keep the production going.”

While keeping more than 100 years of history and tradition, as well as passing on the custom and elegance of the manufacturing technology, TAKAYAMA Instrument continues to make new, innovative instruments. During the visit, it was easy to sense the warmth, seriousness, and passion of the employees and management, as they are never satisfied with the present status and always want to make their surgical instruments better.

At present, Mr. Takayama is occupied mainly with daily production, so he does not have much time to dedicate to research & development, although that may change in the future. His major challenge is to understand every day what is required for surgical instruments to support surgeons in Japan.

TAKAYAMA Instrument is expanding its presence in other regions of the world, for example the USA, Spain, Chili, France,



Fig. 3: Mr. Ryushi Takayama, President of TAKAYAMA Instrument, Inc., shown here in the factory in Tokyo.

Germany, and Greece. In the USA, specifically at the University of California at San Francisco (UCSF), University of Wisconsin at Madison (UWM), University of Pittsburg (Pitt) in Pennsylvania, University of Oregon (UO), University of Detroit Mercy (UDM) in Michigan, and Brigham and Women’s Hospital (BWH) in association with Harvard University Medical School in Massachusetts.

