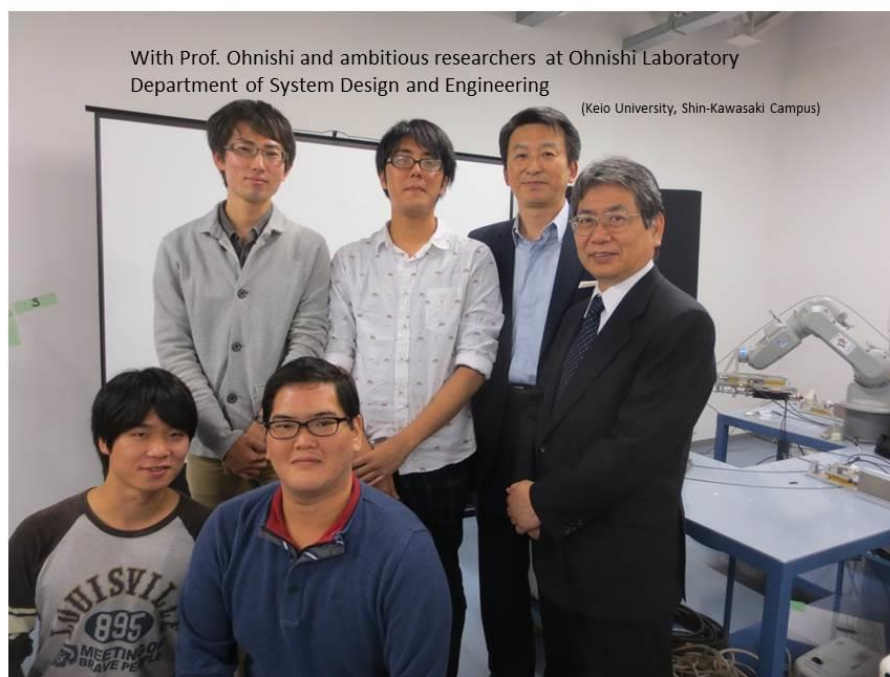


Development of Robot with Haptic Technology for Surgery: “St. Cosmas & St. Damian” Project

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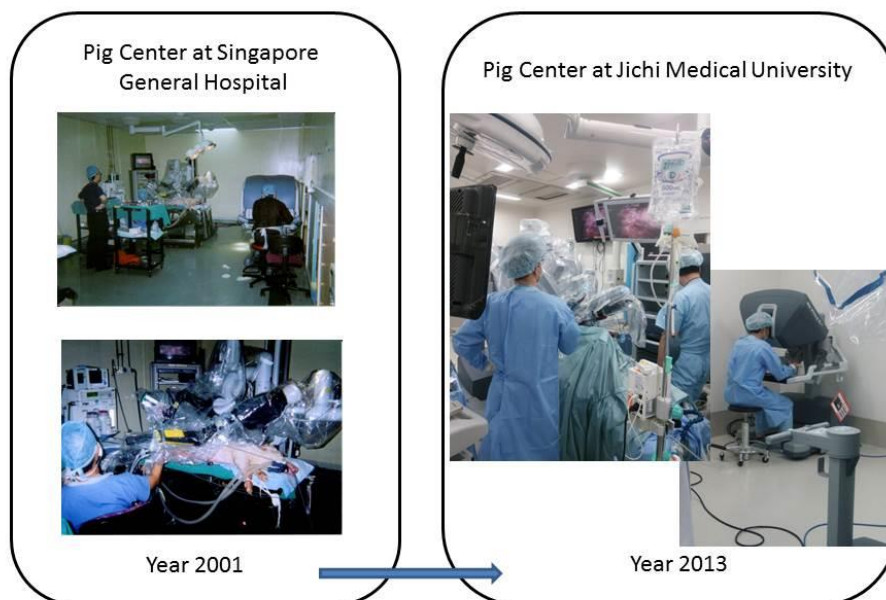
Nowadays, the robots for medical operations such as *Da Vinci* have been getting popularity among Japanese doctors in the surgical fields. I have been involved in the surgical education for many years in Jichi Medical University utilizing the Pig Center as an educational core and in the consequence *Da Vinci* was introduced there for training purposes in 2013. Despite the functionality of so called high-end robot, I deem it extremely necessary to develop totally new robot for surgical purposes considering the points I would refer below.

It is fortunate that we have started designing a device to evaluate the degree of microsurgery education and competitive advantages of the thin threads for microsurgery by utilizing a **haptic** scaling technology of amplifying a subtle microsurgical touch as a joint research with **Prof Ohnishi** Laboratory, Department of System Design and Engineering, Keio University (Photo 1).



For these 20 years, the minimally invasive surgery has been widely accepted as a surgical operation in Japan. However, the delay in making decisions to introduce operations by robots has resulted in more than 10-year behind times against other Asian countries. When I visited in 2001 a general hospital in Singapore to see how *Da Vinci* had been controlled, I was impressed how it helped operations in a way, but simultaneously I felt sure that the robot would never implement a subtle human touch of surgeons (Photo 2).

What would it be if we were over 10-year behind in terms of experience?



Recently thanks to the general acceptance of endoscope operations, surgeons have been brushing up their technique without paying too much attention to the haptic feeling levels. On the other hand, the microsurgery suturing technique still greatly depends on the direct and delicate haptic feeling. Especially the microsurgery suturing by using a thin thread of over 11-0 definitely needs the above technique. As a contradiction, the smooth transfer of this somewhat indispensable surgical technique to young doctors has become more and more difficult. The operations for unborn babies as a next generation requires extremely delicate and subtle operational technique. Judging from these circumstances, **“Haptic feeling”** is definitely necessary for microsurgery which is not required for the endoscope operation by maximizing the ability of eyesight, so-to-speak **“To stop on the spot”**.

I am citing here the ancient painting of St. Cosmas and St. Damian in order to emphasize the fact that there exists basically a difference in time spectrum between the basic research and the applied one (Photo 3)



The painting shows us that these famous two saints replaced the leg of the judge in Rome. It is told that the leg as a donor organ was the one from the Ethiopian condemned criminal. What I'd like to convey through this painting is that since the ancient days there have been attempts to subsidize the lost or missing parts of human body for the organ transplantation, and over the centuries these attempts have become real. I have done liver transplantations as my specialty in organ transplantation. Nevertheless, I have been in doubt how long we still should rely on the donors' organs for transplantation even in the future such as in 50 years, in 100 years. Lots of different approaches have been developed so far for creating organs. Based on these trends, I'd further refer to the subject as below. The terminology "regeneration" is commonly used in this research field. In my course of study I have concluded in using "Organ Fabrication" which fits better for the purpose of fabricating the organ again. In my knowledge acquired over the years I would give you the updated trends divided into three research fields.

The haptic technology that **Prof Ohnishi** Laboratory has been developing is that we can control mutually-supporting haptic movements between master and slave devices. As a joint research we'd like to develop a device utilizing this haptic technology of Ohnishi Laboratory by combining with the implication of **St. Cosmas & St. Damian** in mind which I have been teaching for surgical education for a long time.

It would be our utmost honor if we could expect some companies' collaboration with a strong affirmation to help us accelerate our R&D.

Please click the following URL to have an access to **Prof Ohnishi** Laboratory website;
<http://www-oml.sum.sd.keio.ac.jp/?lang=en&PHPSESSID=30306b373c718673dac91ecdcd2d5720>