Symposium 3

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Career

2011- Present	Director of 22nd Century Medical and Research Center
2001-Present	Chief of Division of Tissue Engineering
1996-Present	Professor of Department of Oral and Maxillofacial Surgery, Graduate School of Medicine, University of Tokyo
1992-1996	Associate Professor of Department of Oral and Maxillofacial Surgery, University of Tokyo
1989-1992	Assistant Professor of Department of Oral and Maxillofacial Surgery, University of Tokyo (1990 July - 1991 May Toronto Sick Children's Hospital, Plastic Surgery Division)
1987-1989	Chief of Plastic Surgery Division, Shizuoka Sick Children's Hospital
1985-1987	Chief of Plastic Surgery Division, Bokuto Metropolitan Hospital
1983-1984	Staff of National Cancer Center, Head and Neck Division
1979-1983	Residency-Plastic Surgery Division, Tokyo University Hospital and Hyogo Sick Children's Hospital

Education

1973-1979	University of Tokyo, Faculty of Medicine (Graduate School)

The novel methods of creating three-dimensional tissues and organs

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In the oral and maxillofacial region, autologous grafting has been conducted to treat tissue defects due to congenital anomaly, trauma or tumor resection. However, as long as autologous grafts are used, these operations must include the process of harvesting patients' tissues, and the amount obtained for grafts may be limited. To overcome such issues with the conventional approach, we have tried to develop tissue-engineered bone and cartilage with 3 dimensional (3D) structures and mechanical strength.

Until now, we have developed custom-made artificial bone (CT-Bone) using 3D printer. Although CT-Bone has a complexed outer shape, it doesn't have inner structures which enable cells to attach and differentiate into osteoblasts. As a result, replacement of the artificial bone by the native bone progressed quite slowly. In addition, we made regenerative cartilage for the nose, of which safety and efficacy have been examined in clinical trial. Although the poly-L lactic acid scaffold enables auricular chondrocytes to attach and generate cartilage matrix, it has simple shape, limiting the application of this technique to the cartilage defects in other regions. To solve these problems, now we are promoting a project to develop a 3D bioprinter with which cells and growth factors can be injected in addition to scaffold materials. In this project, we will regenerate bone, skin, meniscus, cartilage and knee joint by mimicking both outer shapes and inner structures of native tissues. For each target organ, appropriate inner structures, cells, and ideal combination of the materials have been examined.

We are also engaged in research on ear reconstruction using induced pluripotent stem cells (iPS cells). We first induced small cartilaginous particles from iPS cells, and transplanted the auricular-shaped scaffolds containing the cartilaginous particles subcutaneously in the nude rats. We have observed that the transplants remained the initial ear shape for more than 6 months.

Human ear reconstruction using iPS cells