Biomechanics (Biodesign)

1. Staffs and Students

Professor	Kazuo TAKAKUDA	
Assistant Professor	Yoshihisa KOYAMA	
Research Assistants	Syukan OKANO	
Graduate Students	Takayuki ARITA,	Takao IRIBE,
	Kazunori UEDA,	Hiroyuki KADONO,
	Yuki SAITO,	Hiroshi YANAGIDA,
	Teruaki YOSHIDA,	Hazuki KOSHITOMAE,
	Ryo KOKUBUN,	Yutaka FUKUDA,
	Masahiro WATANABE,	Atsushi MITA,
	Tetsuro WATANABE,	Takashi KITAO,
	Kimihiro OKANO,	Ryoichi SUZUKI,
	Katsunari MURAKAMI,	Hiroki IKEDA,
	Tarou KIMURA,	Hiroyuki KUSABA,
	Hisaya NOMATA	
Research Student	Atsushi YAGIHARA	

2. Purpose of Education

Biomechanics

The class is for the understanding of fundamental concepts of mechanics, and introduction to the advanced studies including the biomechanics of living bodies, tissues, and cells. Some applications to the basics of medical devices with mechanical functions are also discussed.

3. Research Subjects

1. Remodeling of structural and supporting tissues under mechanical stimuli

Biomechanical studies on structural/supporting tissues such as bones, ligaments and tendons are carried out. In particular, to elucidate the adaptation mechanism of these tissues, the effects of controlled mechanical stimuli applied to living cells and tissues are investigated.

2. Development of Bone Regeneration Device with Bioabsorbable Organic/Inorganic Composite Materials

Devices for bone regeneration with the use of bioabsorbable Organic/Inorganic Composite materials are developing. In vitro and animal experiments are carrying out for pre-clinical experiments. Furthermore, bone regeneration mechanism when implanting Organic/Inorganic composite materials is examined by in vitro and in vivo tests.

3. Development of Regeneration Devices for Soft Tissues with the use of bioabsorbable materials

Regeneration technology for structural/supporting tissues such as ligaments, tendons, dura mater, peripheral nerves and small blood vessels are investigated utilizing bioabsorbable polymers. Our strategy is based on the regeneration by the self-healing mechanism achieved through the optimum milieu provided by biomaterials. We already have promising results in the animal experiments for the cases of dura mater and peripheral nerves.

4. Development of Soft and Flexible Resin Base Dentures for Elderly Persons

We are developing innovative soft and flexible resin base dentures those are able to moderate the stimulation to mucous membranes and give the patients to get the moderate masticatory force for elderly persons. As the soft and flexible materials for the denture base, we have developed copolymer of 2-ethylhexyl methacrylate and methyl methacrylate that shows relatively hard properties or very soft properties depending on the amount of the contents. By utilizing these new materials, we are now designing new soft and flexible resin base dentures with gradient functions.

4. Publications

Original Articles

1. Kawai T, Yamada T, Yasukawa A, Koyama Y, Muneta T, Takakuda K. Biological fixation of fibrous materials to bone using chitin/chitosan as a bone formation accelerator. *J Biomed Mat Res*, 2009; 88B(1): 264-270.
2. Yoshioka T, Onomoto H, Kashiwazaki H, Inoue N, Koyama Y, Takakuda K, Tanaka J. Improvement of Biocompatibility of Chitosan Fiber Modified by Ca-Phosphate Deposition through an Alternate Soaking Process. *Materials Transactions*, 2009; 50(6): 1269-1272.

3. Yanagida H, Okada M, Masuda M, Ueki M, Narama I, Kitao S, Koyama Y, Furuzono T, Takakuda K. Cell adhesion and tissue response to hydroxyapatite nanocrystal-coated poly(L-lactic acid) fabric. *J Biosci Bioeng.*2009; 108(3): 235-243.
4. Nakamura T, Iribe T, Asou Y, Miyairi H, Ikegami K, Takakuda K. Effects of compressive loading on biomechanical properties of disc and peripheral tissue in a rat tail model. *Euro Spine J.* 2009; 18(11): 1595-1603.

Presentations

1. Takakuda K, Kawai T, Yamada T, Yasukawa A, Koyama Y, Muneta T. ACL Reconstruction with Chitin/chitosan Coated Nonwoven Fabrics in a Rabbit Model. Fourth Asian Pacific Conference on Biomechanics (Christchurch, New Zealand), 2009 April.
2. Takakuda K, Ohrui H, Koyama Y, Yasukawa A. Accelerated Fusion of Surgical Wound with Low Reactive-Level Laser Therapy. Fourth Asian Pacific Conference on Biomechanics (Christchurch, New Zealand), 2009 April.