

大阪大学臨床医工学融合研究教育センター(MEI)センター
グローバルCOE「医・工・情報学の融合による予測医学基盤創成」
—*in silico medicine* を指向したオープンプラットフォームの構築—

グローバルCOEプログラム

■若手研究者短期留学・滞在■

- 氏名■ Zhou Fang
- 所属■ National University of Singapore
- 身分■ Fulltime PhD Student
- 滞在期間■ 6日間 (2011/11/27~12/3)
- 受入先■ 大学院歯学研究科 教授 高田 健治

■報告■

During the six days visit to Osaka University we had numerous meeting with prof Takada and Dr. Yagi.

We presented our latest research topics in the area of dental imaging, and our future research plan. Prof Takada and Dr. Yagi, with their many years of experience in this area, gave us many constructive comments and recommendations to our work, and have shared the result of their relevant work with us.

I presented our current primary work on using multiple camera based surface facial marker as an alternative for common jaw tracking device.

Prof Takada was very positive about our idea. As a clinician, he told us that although Jaw tracking device is accurate and commonly used for decades, it is

not liked by dentist, because the patients often feel uncomfortable with the look of the device, and the dentist often spending one full hour just to educate and comfort their patients before the use. Thus Jaw tracking device is not being used as widely as dentist will have preferred. He also told us that, the 0.2mm or so of accuracy obtained by traditional Jaw tracking is often not required by the dentist. An accuracy of 0.7mm or even 1.0mm will probably be sufficient for most diagnosis.

Dr. Yagi share with me his work on facial emotion, which is similar to ours in the sense that optical markers was also placed on the face of the human target.

I also presented my future research topics of using modelling of mastication process, and the use of surface markers to diagnose facial abnormalities.

Prof Takada gave his suggestions to the methods and possibilities around the area of facial surface markers. He suggested that we slip the face and investigate different regions separately. He recommend me to use markers placed at the lower region of the face for jaw tracking purpose, because the lower jaw is less affected by emotional muscles and any movement on the skin is dominated by jaw movement. He also suggested that we can consider looking into the area of facial emotion, by looking at surface markers around the mid region of the face. This will be a good region because the movement of the skin in the mid region of the face is mostly a result of the muscles underneath, and the disturbance due to jaw movement is very minimal. This will be good for looking at the interaction of the three layers on the face, the skull, the muscles and the skin (including fat tissue and connecting tissue). As the skull is fixed, a study of how the muscle movement will drag the outer skin can be done. It will involve the modeling of the friction between the muscles and skull, and between muscles and the skin. Elasticity models of the skin will be required, Prof Yagi had relevant work and data in this area, and he agreed to help us in the process. Prof Takada also asked

about the possibility of using dynamic MRI for the study of muscle movement caused by facial emotions. Professor Kelvin Foong from our team explained to them that although National University Hospital in Singapore has MRI capable of dynamic imaging, the maker Siemens has not release a protocol for dynamic imaging, and we have to wait for the a few more month. During the discussing I had the idea that MRI sensitive surface markers can be applied on the facial skin before dynamic MRI, then we will potentially have the dynamic information of both skin, muscle and skull (via bone shadow) simultaneously, which will be extremely useful to our area of research. At the meantime, we just have to wait for Siemens to release their protocol.

My presented topic of modeling of mastication muscle is to use 3D models from MRI and CBCT, and surface data from 3DMD and surface motion capture, using FEM method to build a mechanical model and investigate the mechanic of mastication process.

Dr. Yagi suggested that I can first start with a general model, with the shape, length and angle of the skull and muscles parameterized. The reason is that a patient specific model will be difficult to obtain and to time consuming to process, with a parameterized and adjustable general model, different types of facial construction can be studied with just a turn of few clinically measurable parameters. I agreed and have adjusted my plan accordingly.

Regarding my plan for modeling of mastication process, Prof Takada was very generous to share his over thirty years of experience in this area's research. He reminded me of the complexity of mastication system, the sensory circuit involved, the feedback and feed forward system, and the long time it took a human to learn the mastication process from since birth. He agreed that the modeling is useful, and advised me to narrow down the scope of modeling and simulation.



During my short stay the faculty staff and Ph.D student who were very helpful and friendly, I received many help and advices, both for academics and for getting around in Japan. I will like to thank all of them for their generosity.

