グローバルCOEプログラム

■若手研究者短期留学・滞在■

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■報告■

This is the second time I have visited Osaka University by the invitation from Prof. Takada. I am very honored to present my research work here, and discuss some potential researches with the faculties and the PhD students from School of Dentistry, Osaka University.

During the 6 days, I have not only shared the achievement of the research collaboration between Osaka University and National University of Singapore, but I also learned a lot of new things from Osaka University. According to the discussions of last time on February this year, we have discussed and verified that the three dimensional morphologic changes of muscle could be a more prominent feature of muscle activity than changes in the muscle volume, the muscle cross-sectional area and the muscle length during the mandibular movements. Thus we decided to start a research collaboration between the 2 Universities for developing a new method to study the functional activity of

masticatory muscles. I am very honored to be responsible for this collaborated research. After I was back to Singapore, I have applied the shape context method which can determine the corresponding relationship by its highly discriminative and robust score for measuring the similarities between two models the morphologic changes, and done some experiments on the masseter muscles and the lateral pterygoid muscles from two subjects.

Research Presentation

Discussion with Dr. Yagi

Here I briefly introduce the achievements of the research collaboration between National University of Singapore (Prof. Foong's team) and Osaka University (Prof. Takada's team), the following two collaborated researches have been started on February 2011.

Masseter Muscle

Current techniques that study the functional activity of masseter muscle are unsuited of fully describing its functional role. The aims of this study were to develop a method quantifying the three-dimensional morphologic changes of masseter muscle during mandibular movements, and to relate the three-dimensional morphologic changes of the masseter muscle with its functional activities. Two healthy adult subjects underwent magnetic resonance (MR) scans of the head at four mandibular positions: mandibular rest (M0), maximum intercuspation (M1), medium jaw-opened (M2), and maximum jaw-opened (M3) positions. The three-dimensional models of masseter muscles of each subject were reconstructed from the MR images, and the three-dimensional morphologic changes of the masseter muscles from M0 to M1, from M0 to M2 and from M2 to M3 were quantified by directions and magnitudes of the displacements between pairs of corresponding points on the muscle models. This method provided a quantification of functional activity along the entire body and at specific anatomic compartments of masseter muscle. Furthermore the direction of the masseter muscle contraction force can be indicated by the resultant direction of the three-dimensional morphologic changes, thereby enabling future realistic subject-specific studies in masseter muscle architecture and function. In addition, we also found that the superficial compartment may control mandible move to anterior, and the deep compartments may control mandible move to posterior. This finding has not been published in any articles. For this research, I have written a manuscript for Journal of dental research. Now I am working on the paper revision.

Lateral Pterygoid Muscles (Accepted by **62nd AAOMR Annual Meeting)**

Background. Existing techniques that study the functional activity of the lateral pterygoid muscle (LPM) are incapable of fully describing the functional role of the LPM [1,2].

Objectives. (1) To present a new methodology quantifying three-dimensional (3D) morphologic changes of LPM during mandibular movements and (2) correlate morphologic changes of LPM with its functional activity.

Methods and Materials. Two adult male volunteers underwent magnetic resonance (MR) scans of the head at three mandibular positions: mandibular rest (M0), medium jaw opened (M1), and maximum jaw opened (M3) positions. The 3D LPM models of each subject were reconstructed from the MR images. 3D morphologic changes of the LPM from positions M0 to M1 and from M1 to M2 were determined by the direction and magnitude of the displacement between pairs of corresponding points on the LPM models (Figure 1). This study has the Institutional Review Board approval coded NUS-IRB 04-157.

Results. Twelve LPM models, based on the three mandibular positions, were reconstructed (Figure 2). The directions and magnitudes of the morphologic changes of the LPM models are demonstrated in the corresponding point maps and colour maps, respectively (Figure 3).

Conclusion. 1. 3D morphologic change is a more prominent feature of muscle activity than changes in volume, cross-sectional area and length during mandibular movements. 2. This method visualizes the quantitative changes of muscle shape during function along the entire body and at specific parts of the lateral pterygoid muscle. . The direction of lateral pterygoid muscle contraction during mandibular opening can be determined by the calculated resultant direction of the 3D morphologic changes.

References.

1. Naidoo LC, Juniper RP. Morphometric analysis of the insertion of the upper

head of the lateral pterygoid muscle. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997; 83:441-6.

2. Ruangsri S, Whittle T, Wanigaratne K, Murray GM. Functional activity of superior head of human lateral pterygoid muscle during isometric force. J Dent Res 2005; 84:548-53.

In addition, I am thinking about the next research topic. Based on our pilot studies on masseter muscles. We have found the superficial part and deep part of masseter muscle have the differing function. i.e., the superficial compartment may control mandible move to anterior, and the deep compartments may control mandible move to posterior. For further study the functional activities of superficial and deep compartments, I plan to investigate the morphologic changes in the superficial compartment and deep compartment during the different contact points. Thus I have discussed with Dr. Ida and Dr. Tome about how to define some important and meaningful clenching positions. My consideration are that at first we define 3 or 4 meaningful clenching positions (may be with different contact points), and then make the volunteers undergo the MR scan of head with the defined clenching positions. After data acquisition, we can apply the shape context method to quantify the morphologic changes of these masseter muscles. The results could show some correlations between the contact points and the changes in superficial part and deep part.

I hope we can visit Osaka University again, and our research collaboration can proceed smoothly, and create a lot of achievements .