

## Evaluation of Glucose Metabolism in the Stomatognathic System and the Brain during Gum Chewing by Using Positron Emission Tomography



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Recently Positron Emission Tomography(PET) has been applied as a noninvasive method to investigate tissue energy consumption in various organs on function. With use of  $^{18}\text{F}$ -fluoro-deoxy-glucose(FDG), tissue energy consumption in the brain and the muscles can be measured by PET. In this study, FDG-PET study was performed to estimate functional energy consumption in the skeletal muscles related to mastication and in the brain during gum chewing.

Twenty seven healthy male subjects aged 21 to 32 years were recruited to participate in this study. They were divided into three groups(Group A:resting as control, Group B:chewing gum on the right side, Group C:chewing gum arbitrarily). Each subject was intravenously injected with approximately 56 MBq of FDG when each task for 30 min was started. After completion of each task, PET scan was performed. Then visual identification of the areas with increased FDG uptake in the muscles and ROI analysis were carried out. The brain images were analyzed statistically using Statistical Parametric Mapping(SPM96) software package.

According to the PET images of the upper neck and face, FDG uptake by gum chewing in the masticatory muscles especially in the masseter muscles in both Group B and C was found to be spatially heterogeneous. On the other hand, FDG uptake in the tongue muscles was relatively homogeneous even in the subjects who chewed on the right side(Group B). Mean standardized uptake ratio(SUR) that is an indicator of relative uptake of FDG by tissue showed high energy consumption in the intrinsic tongue muscles and the lateral pterygoid muscles in Group C. In Group B, the left lateral pterygoid muscles revealed the highest mean SUR in all the muscles investigated.

With respect to the brain, the bilateral primary sensorimotor area and the bilateral premotor area were highly activated by gum chewing in Group C. In Group B, these areas were also activated bilaterally while activity patterns were different from that of Group C, *i.e.*, the left primary sensorimotor area and the premotor area and the right cerebellum showed relatively high activation in Group B.

In conclusion, the masticatory muscles act heterogeneously while the tongue muscles act rather homogeneously in a mass on function. Activities of the lateral pterygoid muscles and tongue muscles are relatively high compared to other muscles related to gum chewing. The sensorimotor area and the cerebellum are bilaterally activated during gum chewing whereas activity pattern varies depending on the chewing manner. The FDG-PET study enables to evaluate functions of the stomatognathic system and the brain during chewing. In future prosthetic treatment, these functions should be taken into consideration so as to maintain them properly.