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Oculo- and skeletomotor coordination by cortical control in reaching

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Eye movements are essential to gaze visual objects with foveation at the center of the retina (fovea) where our visual acuity is the best. In the brain, visual information is first processed on the basis of location on the retina, known as retinotopy. The retinotopy in the visual system, such as primary and non-primary visual cortex and the superior colliculus, is largely occupied by the visual field of less than 10 degrees centered at the fovea, supporting the best visual acuity at the fovea. The retinotopy is further transformed to head-centered visual coordinates that contribute (1) to stabilization of our visual fields during eye movements and (2) to generation of coordinated oculo- and skeletomotor movements in reaching. In my talk, I will summarize the recent progress in this field including our own studies. In our studies using monkeys who performed a reaching task by either eye or hand, or both, we recorded and analyzed neuronal activity in the frontal cortex crucial for reaching: the peri-arcuate cortex including the ventral pre-motor cortex (PMv) and the frontal eye field (FEF). We found distinct types of neuronal activities in the areas before and during eye and/or hand movements. Analyzing the neuronal activities, we suggest that the superficial FEF is specialized for saccades, whereas the PMv plays a role in reaching transforming coordinates from visual to motor space. Importantly, it became evident that the cortical region lying between the areas plays crucial roles in coordinated eye-hand movements and monitoring required movements.

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Unusual foveal manifestations on OCT

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In the era of OCT, we are often asked to make a diagnosis relying on an OCT appearance. The following cases represent two extreme varieties of unusual foveal conditions. The first is foveal hypoplasia which may be isolated or associated with other ocular conditions and characterized by the continuity of the inner retinal layers in the fovea with variable degrees of decreased foveal pit and absence of cone specialization. Decreased visual acuity and nystagmus may be present, dependent on the degree of hypoplasia. The improved resolution of OCT helps to diagnose and differentiate the degree of foveal hypoplasia. The second condition is a "double fovea" configuration on OCT which was first suspected to be an evolutionary remnant of ancient foveal configuration presently found in birds. A careful clinical examination and using a different scanning plane helped to discover the reason of this unusual appearance on OCT. Both examples show that OCT is a very important tool for diagnosing and characterizing different foveal conditions but is an adjunct to a careful clinical examination and that its interpretation is meaningful only in that context.

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