Tai Chi improves balance control by promoting neuromuscular function

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Abstract: Objective: Tai Chi is believed to improve balance control and reduce falls among older adults; however, the mechanism is yet fully understood. **Methods:** Previous studies indicated that Tai Chi improves balance control primarily by enhancing muscle strength, we conducted a series of experiments to verify that Tai Chi improve balance control by promoting neuromuscular functions. Experiment # 1, Tai Chi practitioners did not show better balance control during stair walking, indicated that the effect of Tai Chi on improving muscle strength may not be enough to improve balance control during stair walking. Experiments # 2 and 3, Tai Chi practitioners had better balance control during stair walking in lower illumination environment or dual-task condition, indicated that the effects of Tai Chi on balance control could be showed in some conditions in which individuals need to better "sense" the environments. Experiment # 4 is a fundamental study, in which we investigated the relationship of proprioception, cutaneous sensitivity, and muscle strength with the balance control among older adults, the outcomes indicated that proprioception is related to dynamic and static balance control, tactile sensitivity is related to static balance control, and muscle strength is related to dynamic balance control, pointed out that proprioception, tactile sensitivity and muscle strength are key elements to balance control. Experiment # 5, a 24-week Tai Chi practice could improve knee flexion/extension strength among older adults with peripheral neuropathy, indicated that Tai Chi improves the function of lower extremity muscles. Experiment # 6, a 16-week Tai Chi intervention improved tactile and proprioceptive sensitivities among older adults, indicated that Tai Chi improves the function of the peripheral nerves. Experiment # 7, one-year regular Tai Chi practice can improve neuromuscular reaction function in elderly women, as indicated by the shorter reaction time of 4 lower extremity muscles, pointed out that Tai Chi could promote the coordination of muscle and nervous systems. Experiment # 8, Tai Chi practitioners take advantage of their better sensations and strength to have superior visuospatial ability and postural stability during standing with goal-directed upper body movements, indicated the effects of Tai Chi on muscular and nervous functions are critical to improve balance control. Experiment # 9, Long-term Tai Chi practitioners had significantly higher fractional anisotropy in the splenium of corpus callosum than the controllers, indicating better microstructure of the brain white matter in the region, and further pointed out that Tai Chi promotes the function of central nervous system. **Conclusion:** We conclude that Tai Chi improves balance control by

promoting neuromuscular functions, i.e., muscle function (muscle strength), nervous function at both peripheral and central levels, and the coordination of muscle and nervous systems.

Key words: Tai Chi, proprioception, tactile sensitivity, muscle strength, neuromuscular Function