Low frequency oscillations in blood pressure (mayer waves) as a marker of autonomic effects of Taijiquan and Qigong

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Abstract: Background: Western medicine relies on blood pressure (BP) to track autonomic nervous system (ANS) activity; thus continuous measurement of BP waveforms has gotten considerable attention over the years. One kind of BP waveform that remains puzzling but intriguing is the so-called Mayer Wave, (MW), a low frequency BP waveform that oscillates at approximately 0.1 Hertz (every 10 seconds). MWs were first seen in the 19th Century by Western medical scientists in exsanguinated animals, and perhaps for that reason have remained largely associated with cardiovascular baroreflex and respiratory pathology in animals and possibly humans. With the development of electroencephalograph (EEG) and other neurological-investigative technologies, new research shows that MWs result from complex signaling between the baroreflex, respiratory rhythm, and specific regions of the brainstem that govern the ANS, which controls the entire visceral nervous system. More recently, low frequency oscillations (LFOs) in BP as well as heart rate variability (HRV), spanning 0.02 to 0.15 Hertz (thus including the MW 0.1 Hz frequency), have proven useful in studying the bio-physiological effects of mind-body exercises such as Taijiquan, Qigong, yoga, and mindfulness meditation. Studies that show these mind-body exercises can increase BP and HRV LFOs suggests that practitioners of such exercises can control the autonomic cardiac-visceral nervous system. An industry study published in 2016 in a peer-review journal found significantly different cardiovascular effects between practitioners of mindfulness meditation and a Westernized form of Taijiquan and Qigong called Reflective Exercise (RE), created by the author of this report. **Methods:** Thirty-two volunteer subjects wore a finger cuff artery sensor designed to measure blood pressure and heart rate. Subjects were observed during a general rest interval and then instructed to meditate while using RE or non-specific breathing for about 15 minutes. Cardiovascular parameters were compared prior to and during meditation in each subject. **Results:** The RE group generally showed greater variance of BP and HRV between rest and meditation, and had a large shift in LF compared to practitioners of mindfulness. A spectral analysis showed the emergence of a low frequency

parameter with meditation and is consistent with previous observations of LF during various forms of meditation. Retro-analysis of the data showed that the RE group and a few of the mindfulness group also showed significant increases in BP LFOs within the frequency range of MWs. **Conclusion:** This exploratory study showed that experienced RE practitioners produced significant LF HRV increases—generally considered to be a marker of autonomic balance in the literature—compared to mindfulness practitioners. Retro-analysis of the data also revealed that the RE group and a few of the non-RE subjects showed significant increases in BP LFOs. Thus, cardiovascular LFOs in the MW frequency range may provide a simple, reliable way to study the autonomic health effects of not only Taijiquan and Qigong, but also the other aspects of TCM.