Functional MRI – (how) can it help understand Tai Chi Chuan?[©]



MÉDECINE

SORBONNE

UNIVERSITÉ

TRAN BA Son-Nam, MD Paris, FRANCE





Improves cognitive function (Alzheimer,...)

Decreases musculo-skeletal pain (fibromyalgia...)

Improves motor coordination and balance / reduces the risk of falls

Tai Chi – How does it work ?



Tai Chi and the brain

- Wei et al, PLoS one 2013
- Tao et al, J. Alz. Dis 2017

Increase in grey matter volume in TCC practicioners vs controls

Structure vs function



CAN TAI CHI CHANGE THE WAY THE BRAIN WORKS ?

CAN WE MONITOR THESE CHANGES ?

What is functional MRI ?

• The signal measured by MRI naturally decreases over time

- BOLD effect :
 - Neuron activation -> vasodilation -> local increase in oxy-haemoglobin -> slower decrease of MR signal

















Task or activation functional MRI





CAN TAI CHI CHANGE THE WAY THE BRAIN WORKS ?

CAN WE MONITOR THESE CHANGES ?

CAN TAI CHI CHANGE THE WAY THE BRAIN WORKS?

CAN WE MONITOR THESE CHANGES ?

CAN WE ASSESS THE BRAIN FUNCTION AT REST?









Neural network

Characteristics :

- Number and location of hubs
- Number of pathways
- Strength of the connections
- = functional connectivity

Resting state functional MRI



Figure 1. Cerebral networks identified with fMRI. **Resting State Networks and Consciousness** (2012) Lizette Heine, Andrea Soddu, Francisco Gómez, Audrey Vanhaudenhuyse, Luaba Tshibanda, Marie Thonnard, Vanessa Charland-Verville, Murielle Kirsch, Steven Laureys, and Athena Demertzi doi:10.3389/fpsyg.2012.00295

CAN TAI CHI CHANGE THE WAY THE BRAIN WORKS?

CAN WE MONITOR THESE CHANGES ?

CAN WE ASSESS THE BRAIN FUNCTION AT REST?

CAN TAI CHI CHANGE THE WAY THE BRAIN WORKS ?

CAN WE MONITOR THESE CHANGES ?

CAN WE ASSESS THE BRAIN FUNCTION AT REST?

DOES TAI CHI MODIFY SOME OF THESE NETWORKS ? IF SO... TO WHAT EXTENT ?

Increased Hippocampus–Medial Prefrontal Cortex Resting-State Functional Connectivity and Memory Function after Tai Chi Chuan Practice in Elder Adults

Jing Tao^{1,2,3}, Jiao Liu¹, Natalia Egorova³, Xiangli Chen⁴, Sharon Sun³, Xiehua Xue⁵, Jia Huang^{1,2}, Guohua Zheng¹, Qin Wang¹, Lidian Chen^{1,2*} and Jian Kong^{3*}

Front Aging Neurosc 2016









Methods - population

- 90 subjects
- Age 50-70
- 21 in TCC group (5 days/week for 12 weeks, Yang-style 24 forms)
- 16 in Baduanjin group
- 25 controls

Methods – evaluation

- Cognitive evaluation at t0 and after 12 weeks
- Resting State fMRI at baseline and after 12 weeks
- Region of interest : hippocampus

Results – clinical effect



Results – functional connectivity Controls TCC









Results – functional connectivity



Conclusion

- TCC improves functional connectivity between the hippocampus and the mPFC
- The rs FC increase is correlated with the cognitive performance improvement

Are we there yet ?

- Limitations
 - Small number of patients
 - Small duration of TCC intervention
 - MRI protocol used
 - Statistical significance ?
- No evidence of a clinical effect provided by these studies
- Need for more robust studies, and confirmation of the results

To sum it up...

• YES we can look at the brain of TCC practicioners while they are at rest

• YES TCC induces changes in the pracitioners' brain, both in terms of structure and function

• MAYBE thoses changes can explain some of the TCC health benefits

New questions arise

- How can we explain these modifications ?
- How do these modifications have an effect on health ?
- Epistemological problem : is TCC still TCC when observed by western methods ?