The brain is said to be asymmetrical when the two hemispheres are distinct from each other, structurally or functionally. Asymmetries are correlated with lateralized behavioral and functional features such as language, motor preferences, spatial and emotional processing, etc. It’s unclear how much and to which hemisphere intra-intra individual variation is subject. It is assumed that brain asymmetry is evolutionary, as unilateral computation and control can be more efficient than bilateral computation. It also eliminates the possibility of hemispheric interaction, freeing up other specialized roles and functions for the opposite hemisphere [1] Different types of meditation such as Focused Attention, Open Monitoring, Loving Kindness, Vipassana, Transcendental, Mindfulness, Rajyoga Meditation etc. are practiced widely. Interestingly, some studies have shown potential different degrees or patterns of lateralization among meditators with studies resulting in inconclusive findings. Previous studies exhibited distinct asymmetrical findings in Transcendental and Mindfulness meditators using EEG. Recent studies are considering different meditative states such as Loving-Kindness, Open Monitoring, Rajyoga, etc. to determine hemispheric differences using DTI, MRI, and EEG to obtain structural, functional asymmetries among meditators.

Methods

Hemispheric Dominant Tasks to determine Asymmetry
- Imaginary part of Coherence, Integrating Connectivity; explored to assess Asymmetry [8]

Spectral Analysis (Alpha/Theta Power) [2,12,13]

Frequency Bands (Lower Alpha, Upper Alpha, Theta, Beta, Gamma) [9,10]

Mined Method Approach such as B3-ML, DT-ML3 were implemented.

Fig1. Overview of Hemispheric Asymmetry among Meditators

Introduction

The brain is said to be asymmetrical when the two hemispheres are distinct from each other, structurally or functionally. Asymmetries are correlated with lateralized behavioral and functional features such as language, motor preferences, spatial and emotional processing, etc. It’s unclear how much and to which hemisphere intra-intra individual variation is subject. It is assumed that brain asymmetry is evolutionary, as unilateral computation and control can be more efficient than bilateral computation. It also eliminates the possibility of hemispheric interaction, freeing up other specialized roles and functions for the opposite hemisphere [1] Different types of meditation such as Focused Attention, Open Monitoring, Loving Kindness, Vipassana, Transcendental, Mindfulness, Rajyoga Meditation etc. are practiced widely. Interestingly, some studies have shown potential different degrees or patterns of lateralization among meditators with studies resulting in inconclusive findings. Previous studies exhibited distinct asymmetrical findings in Transcendental and Mindfulness meditators using EEG. Recent studies are considering different meditative states such as Loving-Kindness, Open Monitoring, Rajyoga, etc. to determine hemispheric differences using DTI, MRI, and EEG to obtain structural, functional asymmetries among meditators.

Results

Type of Meditators

Presence of Asymmetry

Cognitive Functions Involved

Electroencephalographic Studies (EEG)

- Novice Meditators (Meditation Thd) [1]
  - Increased Asymmetry in Right Hemispheres
  - Control of attention, visual imagery etc.

- Advanced Meditators [12]
  - No less asymmetry
  - Decrease in cortical activity due to institution of cognitive functions associated with hemisphere

Mindfulness Meditators

- Mindfulness-based stress reduction, Mindfulness and cognitive therapy [4]
  - Left sided anterior frontal alpha activation
  - Associated with positive underlying approach motivation

Rajyoga Meditator [13]

- Higher Theta and Alpha band power in anterior and medial frontal-parietal channel. Left side anterior frontal activation
  - Frontal and Parietal regions are indicative of the regulation of selective and sustained attention. Associated with positive affect and approach motivation

Focused Attention Meditators (FAMO) and Open Monitoring (OMO)

- Dorsal connectivity predominantly increased in the Right hemisphere-FAMO, Beta connectivity predominantly increased in the Left hemispheres-OMO
  - Right Hemisphere Beta: Highly focused on object with getting sensory inputs. Left Hemisphere Beta: Wide attention to all the present moment experiences

Neuroimaging Studies (MRI/DTI)

- Mindfulness based stress reduction (MBBR) [6]
  - Left gray matter activation in hippocampus
  - Indicative of emotion regulation, cortical arousal, learning, memory etc.

- Long term Meditators [14]
  - Stronger Leftward Asymmetry near the posterior intraparietal sulcus
  - Associated with the number of meditation practice years, changes in attention processing

- Loving-Kindness and Compassion Meditation [15]
  - Increased thickness in fronto-insular cortices (Left Ventricle-Lateral PFC and Anterior Insula)
  - Left Ventricle PFC and Anterior Insula suggests to play a role in the generation of emotional states

Discussion

- In particular, specific meditative states impact on hemispheric lateralization which uniquely influences cognition and anatomical asymmetry, requiring investigation using neurophysiological, neuroimaging techniques for consistent outcomes

- To delve into understanding if the structural/functional asymmetries previously present predisposes people to pursue and continue their meditation or meditation in turn forms these asymmetries in the region including attention, emotions, working memory, meta-cognitive awareness etc related to meditative states.

References


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