A Comprehensive Review of Asymmetry in Meditation

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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 inter-intra individual variation is subjected**. 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 potentially 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

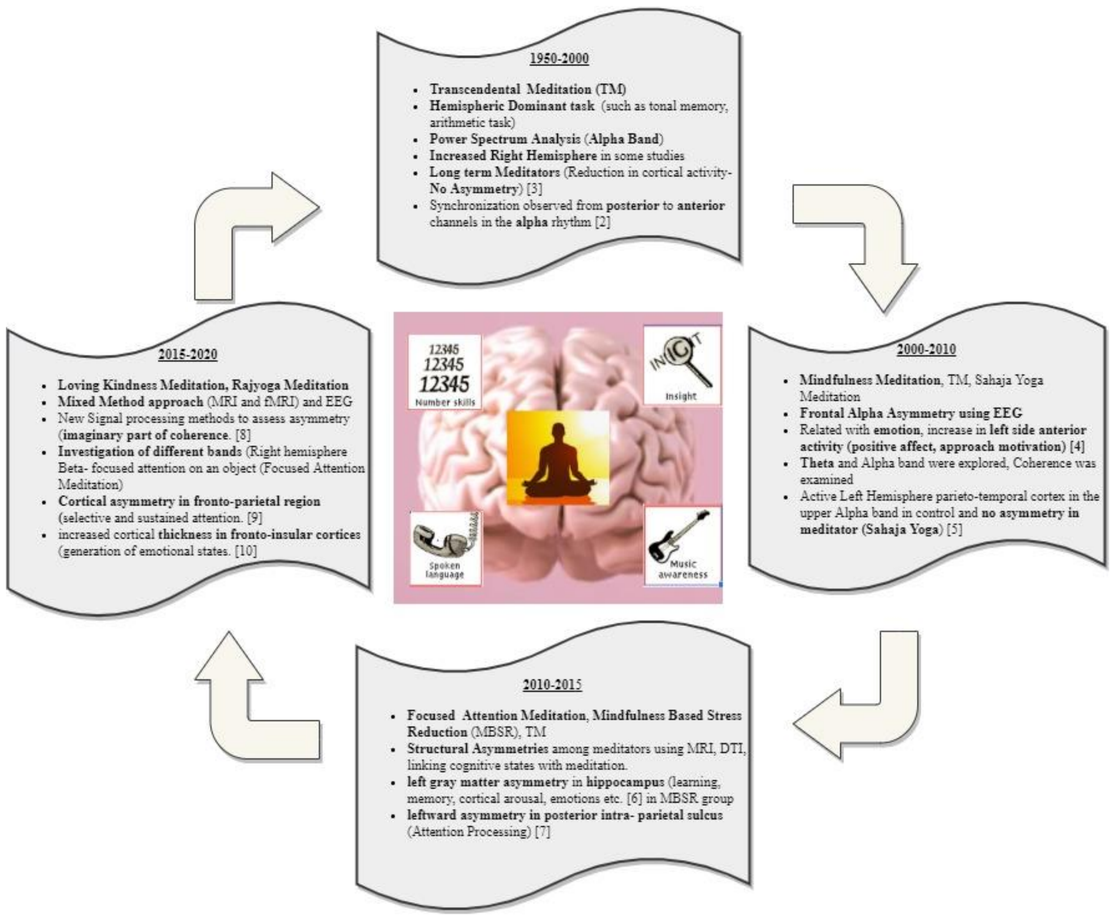
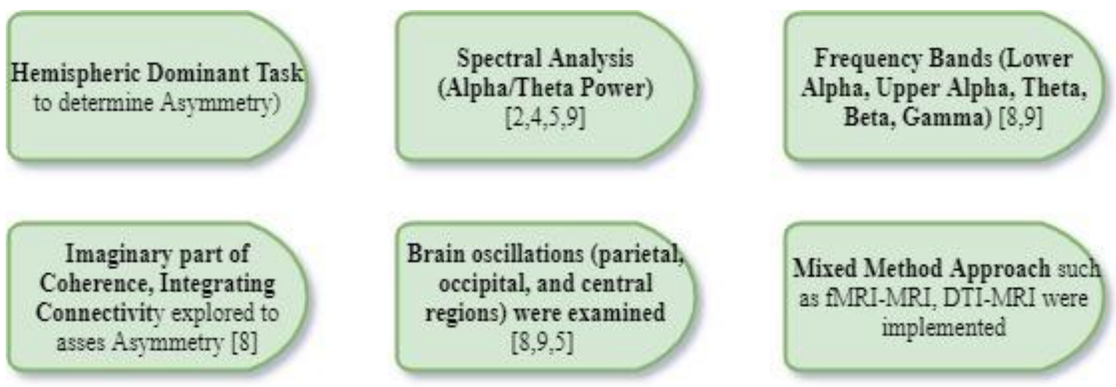


Fig1:Overview of Hemispheric Asymmetry among Meditators

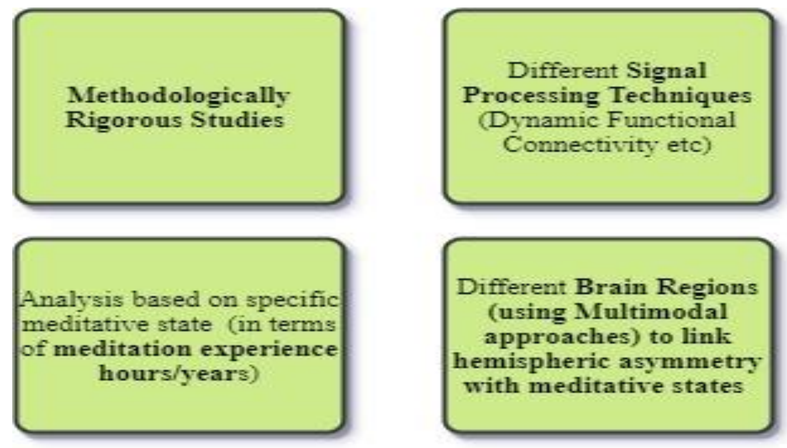
Methods



Results

Type of Meditators	Presence of Asymmetry	Cognitive Functions Involved
Electroencephalographic Studies (EEG)		
Novice Meditators (MostlyTM) [3]	**Increased Asymmetry in Right Hemisphere**	Control of **attention, visual imagery** etc
Advanced Meditators [3,5]	**No/ less asymmetry**	**Decrease in cortical activity due to inhibition of cognitive functions** associated with hemisphere
Mindfulness Meditators, Mindfulness based stress reduction, Mindfulness based cognitive therapy, [4]	**Left sided anterior frontal alpha** activation	**Associated with positive affect and approach motivation**
Rajyoga Meditator [9]	**Higher Theta and Alpha band power in anterior and medial frontal, parietal channels. 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 Meditation (FAM) and Open Monitoring Meditation (OM)	**Beta connectivity** predominantly **increased in the Right hemisphere- FAM, Beta connectivity predominantly increased in the Left hemisphere- OMM,**	**Right** Hemisphere Beta: **Highly focused on object with gatting sensory inputs, Left** Hemisphere Beta: **Wide attention to all the present moment experiences**
Neuroimaging Studies (MRI,fMRI, DTI)		
Mindfulness based stress reduction (MBSR) [6]	**Left gray matter activation in hippocampus**	Indicative of **emotion regulation, cortical arousal, learning, memory** etc
Long term Meditators [7]	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 [10]	**Increased thickness in fronto-insular cortices (Left Ventro-Lateral PFC and Anterior Insula)**	**Left Ventrolateral 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** requires 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**.

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