Delta frequency (0.5-3 Hz) is typically absent during the waking state of healthy adults and is associated with deep sleep (Schandry, 2016).

Beta frequency (14-30 Hz) is typically present when individuals are awake and mentally or physically active, or under psychological stress (Schandry et al., 2016).

Alpha

As expected, the occipital alpha power was reduced in the AD and MCI groups compared to the HC group (D'Atri et al., 2021).

Slowing of alpha power may be an early sensitive indicator of the brain transitioning from normal physiological function to aging or its pathological state [10] (Liu et al., 2024).

Lower power and synchronization of alpha oscillations have consistently been associated with neurodegenerative dementias, especially AD (Jeong, 2004; Lejko, Larabi, Herrmann & Aleman, 2020) [29, 37–39]. These decreases were found to correlate with lower cognitive scores [40, 41] (Lejko et al., 2020).

When compared to the resting state EEG rhythms of healthy normal elderly (Nold) subjects, AD patients showed an amplitude decrease of posterior alpha (8–13 Hz) source [45, 55, 56, 76–78] (Babiloni et al., 2011).

Among the most promising EEG markers are reduced alpha power Cassani et al., 2017; Hatz et al., 2015; Musaeus et al., 2018) (Farina et al., 2020).

As expected, healthy ageing was associated with higher alpha power, both in amplitude (temporo-parietal areas) and connectivity (with frontal electrodes), which was increased in controls relative to patients, and in aMCI relative to AD (Farina et al., 2020).

Compared with healthy older adults, patients with Alzheimer's disease (also early-onset Alzheimer's disease; Özbek, Fide & Yener, 2021) show decreased alpha power during resting state electroencephalography (rsEEG) (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

This study is the first to report that resting-state EEG power can be a promising marker for diagnostic accuracy between EOAD and healthy controls (Özbek, Fide & Yener, 2021).

Findings for mild cognitive impairment (MCI), a stage of increased risk of conversion to dementia, are less conclusive (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). Results indicate no rsEEG power differences between healthy individuals and those with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). This is not in complete agreement with prior findings of changes in the rsEEG in patients with MCI (Fröhlich, Kutz,

Commented [Janka Hau1]: Other literature

Commented [JH2]: The predominant approach in the literature focuses on the analysis of broad frequency bands in the EEG power spectrum, from slow bands, delta (δ:0.1–<4 Hz) and theta (θ:4–<8 Hz), to faster bands, alpha (α: 8–13 Hz), beta (β:14–30 Hz), and gamma (γ: >30–80 H) (Babiloni, et al., 2020).
Perez, Duque, Hidalgo & Salvador, 2024: https://doi.org/10.1016/j.biopsycho.2024.108823

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Commented [JH9]: @article{lejko2020alpha, title={Alpha power and functional connectivity in cognitive decline: a systematic review and meta-analysis}, author={Lejko, Nena ...

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disease. Clin Neurophysiol 115, 1490-1505 ...

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C, Ferreri F, Ferri R, Frisoni G, Hirata K, Lanuzza B, ...

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P, Linden DE, Maurer K, Winblad B, Nordberg A (2000) ...

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Müller & Claudia Voelcker-Rehagen, 2021). For the rest with eyes-closed, it was shown that alpha power was reduced in MCI compared with healthy older adults (Koenig et al., 2005; Babiloni et al., 2006b, 2010; Kwak, 2006; Ya et al., 2015) (from Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

A significant difference between the AD group and groups with objective and subjective memory disturbances was found for delta, theta, and alpha relative power (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). AD group significantly lower alpha relative power in all investigated regions, in relation to the rest of the study population (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). left frontal regions (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). No significant differences between the groups with subjective or objective memory impairment (MCI) when compared to the controls (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996).

Slowing on the electroencephalogram (EEG) in patients with Alzheimer's disease (AD), compared to normal control subjects, evidenced by increase of theta activity and decrease of beta or alpha power, is a uniform finding in previous studies (Claus et al., 2000). Our study therefore suggests that the EEG bands reflect differential pathophysiologic changes in AD (Claus et al., 2000).

Compared with the normal controls, the AD patients had a significantly lower alpha-2 band power in the resting EEG (Wada, Nanbu, Jiang, Koshino, Yamaguchi & Hashimoto, 1997).

Typical EEG changes in AD include a decrease in power and mean frequency of alpha activity (8–12 Hz) [21,39,71,74] (Dringenberg, 2000).

A decrease in alpha activity is repeatedly observed in AD (Jeong, 2004).

Theta

Increased theta power may have a good predictive effect on cognitive decline [11] (Liu et al., 2024).

The severity of cognitive impairment is positively correlated with increased theta activity, and an increase in theta waves in EEG serves as a good predictor of cognitive decline [36] Liu et al., 2024).

These data indicate that high resting theta power in healthy older adults is associated with better cognitive function and may be a marker of healthy neurocognitive aging (Finnigan & Robertson, 2011).

Commented [JH17]: [21] Coben LA, Danziger W, Storandt M. A longitudinal EEG study of mild senile dementia of Alzheimer's type: Changes at 1 year and at 2.5 years. Electroencephalogr Clin Neurophysiol 1985;61:101–12.
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Commented [JH20]: In summary, these outcomes indicate that high resting-state theta power in older adults is associated with relatively greater cognitive impairment;

When compared to the resting state EEG rhythms of healthy normal elderly (Nold) subjects, AD patients showed an amplitude increase of widespread theta source [45, 55, 56, 76–78] (Babiloni et al., 2011).

Among the most promising EEG markers are increased theta power, as well as increased theta band functional connectivity (Cassani et al., 2017; Hatz et al., 2015; Musaeus et al., 2018) (Farina et al., 2020).

Similar to AD models, the best features for distinguishing aMCI from healthy ageing were increased theta power in left temporo-parietal electrodes (Farina et al., 2020).

Theta power was the best overall predictor of patient status, in line with the suggestion that increased theta is one of the first changes to occur in AD (Musaeus et al., 2018) (Farina et al., 2020).

Compared with healthy older adults, patients with Alzheimer's disease (also early-onset Alzheimer's disease; Özbek, Fide & Yener, 2021) show increased theta power during resting state electroencephalography (rsEEG) (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

This study is the first to report that resting-state EEG power can be a promising marker for diagnostic accuracy between EOAD and healthy controls (Özbek, Fide & Yener, 2021).

Findings for mild cognitive impairment (MCI), a stage of increased risk of conversion to dementia, are less conclusive (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). Results indicate no rsEEG power differences between healthy individuals and those with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). This is not in complete agreement with prior findings of changes in the rsEEG in patients with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). For the rest with eyes-closed, it was shown that theta power was either elevated or reduced in MCI compared with healthy older adults (Koenig et al., 2005; Babiloni et al., 2006b, 2010; Kwak, 2006; Ya et al., 2015) (from Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

A significant difference between the AD group and groups with objective and subjective memory disturbances was found for delta, theta, and alpha relative power (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). AD group significantly higher theta relative power in all investigated regions in relation to the rest of the study population (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). No significant differences between the groups with subjective or objective memory impairment (MCI) when compared to the controls (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996).

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Slowing on the electroencephalogram (EEG) in patients with Alzheimer's disease (AD), compared to normal control subjects, evidenced by increase of theta activity and decrease of beta or alpha power, is a uniform finding in previous studies (Claus et al., 2000). Our study therefore suggests that the EEG bands reflect differential pathophysiologic changes in AD (Claus et al., 2000).

Compared with the normal controls, the AD patients had a significant increase in theta band power in the resting EEG (Wada, Nanbu, Jiang, Koshino, Yamaguchi & Hashimoto, 1997).

The AD patients showed highly significant increases in theta activity compared with controls (Elmståhl, Rosen & Gullberg, 1994). The topographical analysis showed a widespread increase in theta power over most cortical areas (Elmståhl, Rosen & Gullberg, 1994).

Typical EEG changes in AD include increased power in the theta (4–7 Hz) band [21,39,71,74] (Dringenberg, 2000).

An increase in theta activity is repeatedly observed in AD (Jeong, 2004).

In the MCI subjects, the EEG markers of disease progression included an increase of the power density at the theta rhythms in the temporal and occipital regions (Jelic et al., 2000) from Babiloni, 2015.

Beta

When compared to the resting state EEG rhythms of healthy normal elderly (Nold) subjects, AD patients showed an amplitude amplitude decrease beta (13–30 Hz) sources [45, 55, 56, 76–78] (Babiloni et al., 2011).

As expected, healthy ageing was associated with higher beta power, which was increased in controls relative to patients, and in aMCI relative to AD (Farina et al., 2020).

Compared with healthy older adults, patients with Alzheimer's disease (also early-onset Alzheimer's disease; Özbek, Fide & Yener, 2021) show decreased beta power during resting state electroencephalography (rsEEG) (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

This study is the first to report that resting-state EEG power can be a promising marker for diagnostic accuracy between EOAD and healthy controls (Özbek, Fide & Yener, 2021).

Findings for mild cognitive impairment (MCI), a stage of increased risk of conversion to dementia, are less conclusive (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

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Results indicate no rsEEG power differences between healthy individuals and those with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). This is not in complete agreement with prior findings of changes in the rsEEG in patients with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). For the rest with eyes-closed, it was shown that beta power was reduced in MCI compared with healthy older adults (Koenig et al., 2005; Babiloni et al., 2006b, 2010; Kwak, 2006; Ya et al., 2015) (from Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

A significant difference between the AD group and groups with objective and subjective memory disturbances was found for delta, theta, and alpha relative power (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). No significant difference was found for beta relative power in the groups studied, but a tendency towards higher values was observed in frontal regions in groups with objective memory disturbance and subjective memory complaints, as well as an increase in the left and right temporal and perieto-occipital regions in the AD group (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). No significant differences between the groups with subjective or objective memory impairment (MCI) when compared to the controls (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996).

Slowing on the electroencephalogram (EEG) in patients with Alzheimer's disease (AD), compared to normal control subjects, evidenced by increase of theta activity and decrease of beta or alpha power, is a uniform finding in previous studies (Claus et al., 2000). Our study therefore suggests that the EEG bands reflect differential pathophysiologic changes in AD (Claus et al., 2000).

Compared with the normal controls, the AD patients had a significantly lower beta band power in the resting EEG (Wada, Nanbu, Jiang, Koshino, Yamaguchi & Hashimoto, 1997).

The AD patients showed highly significant decreases in beta activity compared with controls (Elmståhl, Rosen & Gullberg, 1994).

The topographical analysis showed that the decrease in beta power was more restricted to posterior temporoparietal areas (Elmståhl, Rosen & Gullberg, 1994). The beta power decrease is considered to reflect cortical degenerative changes [26, 27] (Elmståhl, Rosen & Gullberg, 1994).

Typical EEG changes in AD include a loss of beta (13–30 Hz) activity [21,39,71,74] (Dringenberg, 2000).

A decrease in beta activity is repeatedly observed in AD (Jeong, 2004).

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adults and children; in Klass DW, Daly DD
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ration in the elderly. Neurobiol Aging 1994;15:85–90.

In the MCI subjects, the EEG markers of disease progression included a decrease of the power density at beta rhythms in temporal and occipital regions (Jelic et al., 2000) from Babiloni, 2015.

A decrease in beta power has been found in individuals with mild AD (Hogan, Swanwick, Kaiser, Rowan & Lawlor, 2003).

Delta

Prefrontal delta power was significantly higher in the AD compared to the HC group, while the right frontotemporal delta activity increased in the AD compared to both the HC and MCI groups (D'Atri et al., 2021).

In the morning EEG, the three groups showed differences only in the delta band with a prevalence of the delta activity in AD compared to both HC and MCI groups (D'Atri et al., 2021). On the other hand, the EEG activity of the MCI group differed from that of HC only at the frontal sites (D'Atri et al., 2021).

When compared to the resting state EEG rhythms of healthy normal elderly (Nold) subjects, AD patients showed an amplitude increase of widespread delta source [45, 55, 56, 76–78] (Babiloni et al., 2011).

Similar to AD models, the best features for distinguishing aMCI from healthy ageing were increased delta power in left temporo-parietal electrodes (Farina et al., 2020).

Compared with healthy older adults, patients with Alzheimer's disease (also early-onset Alzheimer's disease; Özbek, Fide & Yener, 2021) show increased delta power during resting state electroencephalography (rsEEG) (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

This study is the first to report that resting-state EEG power can be a promising marker for diagnostic accuracy between EOAD and healthy controls (Özbek, Fide & Yener, 2021).

Findings for mild cognitive impairment (MCI), a stage of increased risk of conversion to dementia, are less conclusive (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). Results indicate no rsEEG power differences between healthy individuals and those with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). This is not in complete agreement with prior findings of changes in the rsEEG in patients with MCI (Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021). For the rest with eyes-closed, it was shown that delta power was either elevated or reduced in MCI compared with healthy older adults

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(Koenig et al., 2005; Babiloni et al., 2006b, 2010; Kwak, 2006; Ya et al., 2015) (from Fröhlich, Kutz, Müller & Claudia Voelcker-Rehagen, 2021).

A significant difference between the AD group and groups with objective and subjective memory disturbances was found for delta, theta, and alpha relative power (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). For delta relative power, a lower level of significance ($p<0.05$) was observed in the left and right temporal and parieto-occipital, and left frontal regions (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996). No significant differences between the groups with subjective or objective memory impairment (MCI) when compared to the controls (Jelic, Shigeta, Julin, Almkvist, Winblad & Wahlund, 1996).

Compared with the normal controls, the AD patients had a significant increase in delta band power in the resting EEG (Wada, Nanbu, Jiang, Koshino, Yamaguchi & Hashimoto, 1997). Topographic analyses of the resting EEG showed a significant increase in delta band power at the frontal regions/delta activity was observed predominantly at the frontal areas (Wada, Nanbu, Jiang, Koshino, Yamaguchi & Hashimoto, 1997).

The AD patients showed highly significant increases in delta activity compared with controls (Elmståhl, Rosen & Gullberg, 1994).
The topographical analysis showed a widespread increase in delta power over most cortical areas (Elmståhl, Rosen & Gullberg, 1994). Delta waves are considered to reflect primarily abnormalities of connections between subcortical and cortical areas [26, 27] (Elmståhl, Rosen & Gullberg, 1994).

Typical EEG changes in AD include increased power in the delta (B4 Hz) band [21,39,71,74] (Dringenberg, 2000).

An increase in delta activity is repeatedly observed in AD (Jeong, 2004).

In the MCI subjects, the EEG markers of disease progression included an increase of the power density at the delta rhythms in the temporal and occipital regions (Jelic et al., 2000) from Babiloni, 2015.

Reduced delta power during resting state EEG has been identified in patients with MCI (Liddell et al., 2007). Furthermore, in the study, individuals with MCI demonstrated a significant positive correlation between delta power and immediate memory recall. Liddell et al. (2007) proposed that these findings suggest that delta power may be linked to memory decline in MCI, indicating that it could serve as a sensitive indicator of prodromal or early cognitive decline. However, other studies have shown increased delta power in MCI patients compared to healthy controls, particularly in frontal and centroparietall regions (Adler, Bramesfeld & Jajcevic, 1999; Moretti, Zanetti, Binetti & Frisoni, 2012).

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