

CLINICAL CRITERION OF MCI

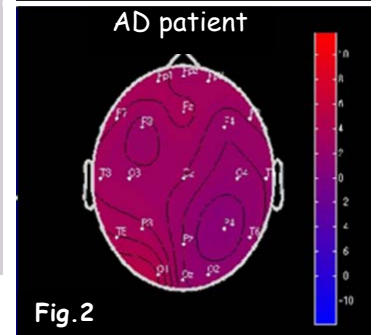
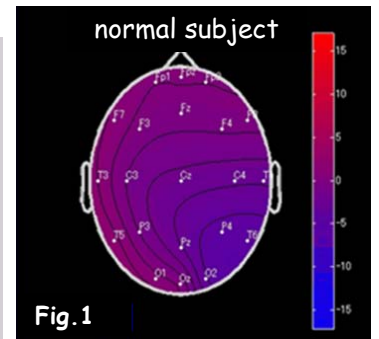
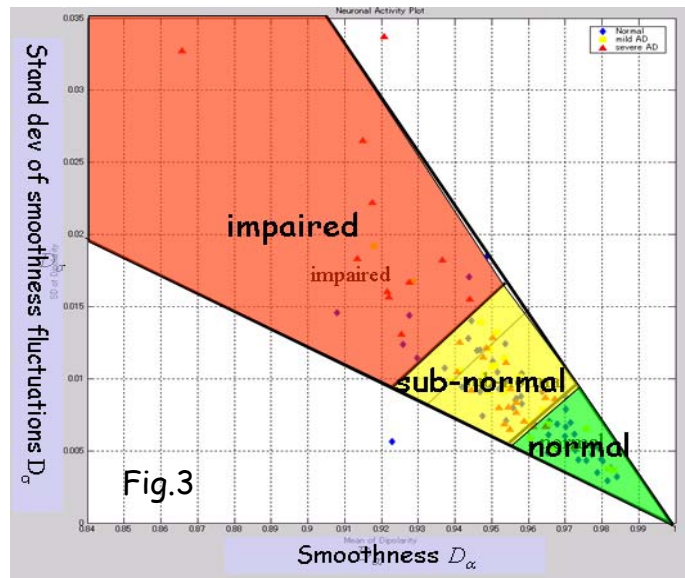
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What is DIMENSION (Diagnosis Method of Neuronal Dysfunction)

Scalp potentials for the EEG alpha-component in a normal subject are well approximated by a potential distribution generated by an optimal single current dipole generator (mathematical model), and its goodness-of-fit (dipolarity) D is close to 1 (Fig.1). In an AD patient the scalp potential distribution is distorted with local neuronal impairments (Fig.2), and the potential distribution becomes unstable. Let the mean and standard deviation of dipolarity be denoted as D_α and D_σ .

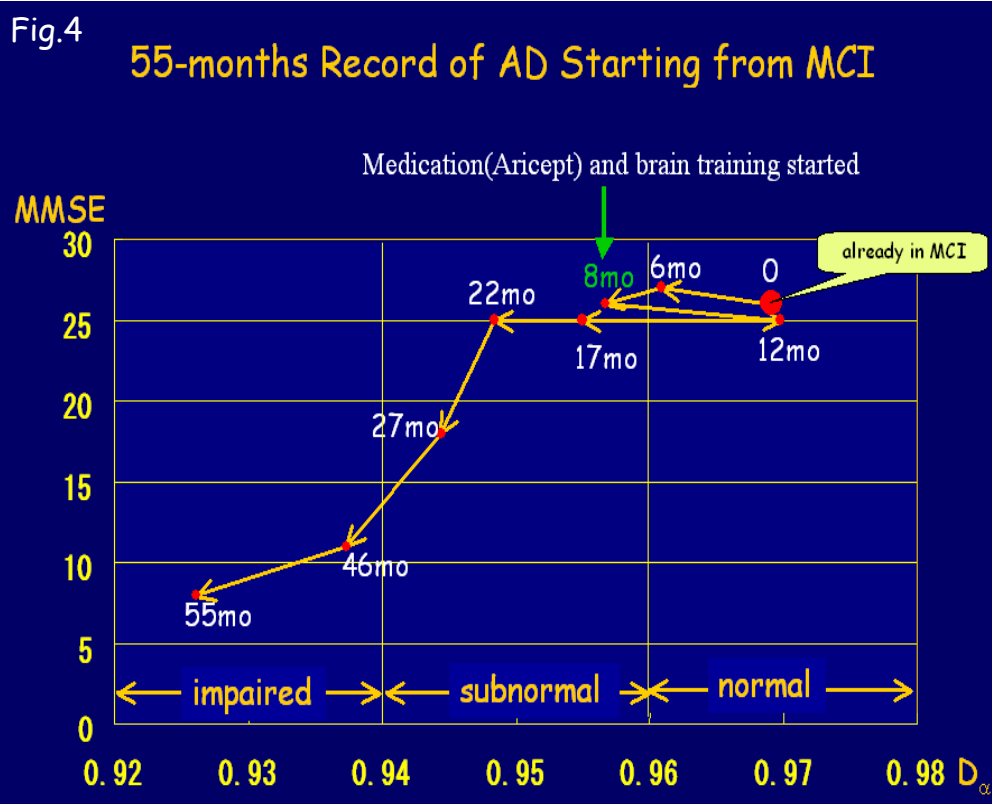
DIMENSION Diagram

D_α and D_σ compose a DIMENSION Diagram as shown in Fig.3, where 25 very mild AD and 33 moderately severe AD patients together with 56 age-matched normal controls were DIMENSION-analyzed. All the data on the diagram are distributed within a fan-beam area. With an increase of the synaptic-neuronal impairment as a result of progression of AD spatial and temporal fluctuations of neuronal activity increase; they are somewhat correlated. It turns out that diagnosis of neuronal impairment can be done in terms of either D_α or D_σ .



Criterion of MCI(see Fig.4)

A patient (female 82 years old) visited our hospital accompanied by her husband complaining severe memory loss. Her MMSE score was 26 and D_α was 0.969 (normal region). Six months later her MMSE score increased to 27 but D_α decreased to 0.961. Two months later her MMSE score was 25 but D_α went further down to 0.957 (subnormal region). Then medication (Aricept) started together with rehabilitation, and four months later her MMSE score still stayed at 25 but D_α was recovered to 0.970 (normal region). In nine months after the medication and rehabilitation started her MMSE was still 25 but D_α was 0.955, hence the effect of the treatment was lost. As is seen in this figure both the MMSE score and the D_α value were going down after the 22nd month. From this trend we conclude the initial state of this patient was **MCI** because *she was not normal nor demented but the neuronal activity was continuously going down.*



References:

- (1) J. Hara, T. Musha and W. R. Shankle, Approximating dipoles from human EEG activity: the effect of dipole source configuration on dipolarity using single dipole models, IEEE Trans. Biomed. Eng., 46, 2, 125-129, 1999; J. Hara, W. R. Shankle and T. Musha, Cortical Atrophy in Alzheimer's Disease Unmasks Electrically Silent Sulci and Lowers EEG Dipolarity, IEEE Trans. Biomed. Eng., vol.46, no.8, 905-910, 1999.
- (2) T.Musha, T.Asada, F.Yamashita, T.Kinoshita, H.Matsuda, M.Uno, Z.Chen and W.R.Shankle, "A new EEG method for estimating cortical neuronal impairment that is sensitive to early stage Alzheimer's disease," Clinical Neurophysiology, 113 (2002) 1052-1058.
- (3) T.Musha, T.Asada, F.Yamashita, T.Kinoshita, H.Matsuda, M.Uno, Z.Chen and W.R.Shankle, "A new EEG method for estimating cortical neuronal impairment that is sensitive to early stage Alzheimer's disease," Clinical Neurophysiology, 113 (2002) 1052-1058..