Using age-matched templates to depict patterns of atrophy in AD and FTD

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OBJECTIVES

Alzheimer Disease (AD) and Frontotemporal Dementia (FTD) are characterized by progressive brain atrophy at variable rates along the age continuum. We suggest using normative templates according of cortical thickness (CTh) within different age ranges.

METHODS

We studied 497 MRIs of healthy controls (CTR), Early Onset AD (EOAD), Late Onset AD (LOAD) and FTD patients. Subjects were grouped according to age (Table 1).

We obtained regional CTh and we generated group-normative maps using the mean and standard deviation (SD) of CTR. Then, Z scores were estimated as $Z_{region} = (CTh_{region} - CTh_{(CTRmean)}) / CTh_{(CTRSD)}$ for each patient with its corresponding template. We compared these maps as well as global values at each age range.

Table 1: Age ranges and clinical groups. m:male, f:female

	45-54 years	55-64 years	65-74 years	75-84 years
CTR	N=6 (m) N=15 (f)	N=24 (m) N=69 (f)	N=19 (m) N=54 (f)	N=7 (m) N=8 (f)
FTD	N=8 (m) N=5 (f)	N=36 (m) N=27 (f)	N=18 (m) N=19 (f)	N=6 (m) N=4 (f)
EOAD	N=7 (m) N=10 (m)	N=36 (m) N=41 (f)	N=3 (m) N=4 (f)	——-
LOAD	——-	——-	N=12 (m) N=31 (f)	N=11 (m) N=17 (f)

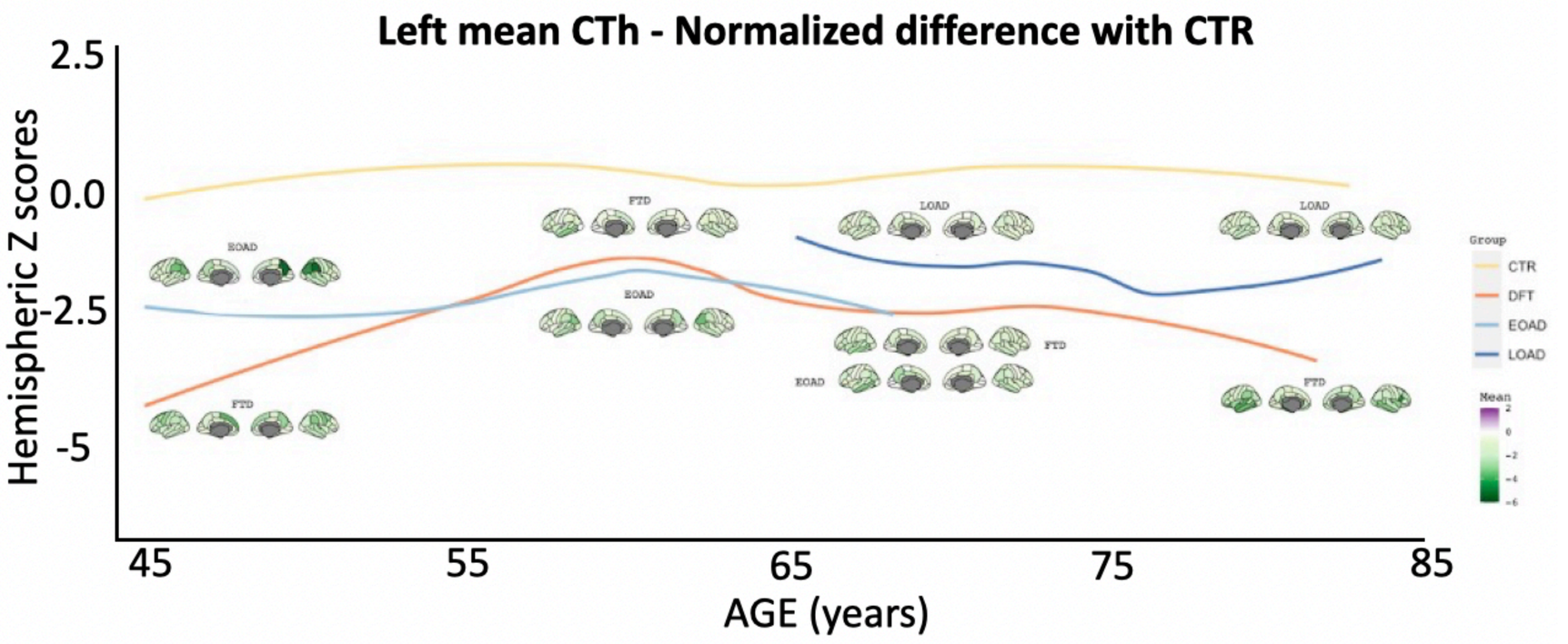

Figure 1: Disease-specific patterns of the difference of CTR for each age group in units of SD. The brain plots show the mean of each CTh values for each age group. We used the average hemispheric CTh to obtain global trajectories using a LOESS fit.

RESULTS

AD and FTD showed brain atrophy compared to CTR at all age groups. LOESS trajectories of whole brain measures were clearly different between diseases. The effects of atrophy for both diseases with respect to CTR were stronger at younger ages (Figure 1). We describe differences between AD and FTD along the aging continuum with different patterns across ages (Figure 2).

Figure 2: Regions with significant CTh differences between AD (EOAD or LOAD according to the age group) and FTD.

CONCLUSIONS

We highlight the necessity of using age-matched templates to identify changes across the disease timeline for AD and FTD. At younger ages, EOAD and FTD had partly overlapping brain signatures. At older ages, LOAD and FTD clearly show a different pattern. These patterns can be used to support the differential diagnosis of these dementias.

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