Resting state functional connectivity is affected by testosterone treatment in female-to-male transgender persons

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Background

Several resting state networks have been described in literature. Today, it is still unclear whether these networks are stable or can be influenced by sex hormones. Transgender persons offer a unique opportunity to study these hormonal influences.

Aim

To examine the effects of cross-sex hormone treatment in transgender persons on two resting state networks involved in cognition and emotion, the default mode network and the executive control network.

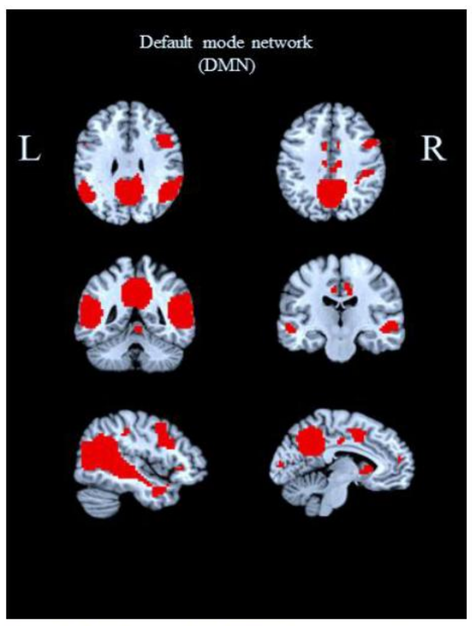

Figure 1. Spatial map of the DMN during cross-sex hormone treatment in female-to-males.
Included anatomical areas were the bilateral posterior and middle cingulate gyrus, bilateral angular gyrus, bilateral precuneus, bilateral superior medial frontal gyrus, bilateral middle temporal gyrus, bilateral supramarginal gyrus, vermis and right calcarine, frontal inferior and postcentral gyrus.

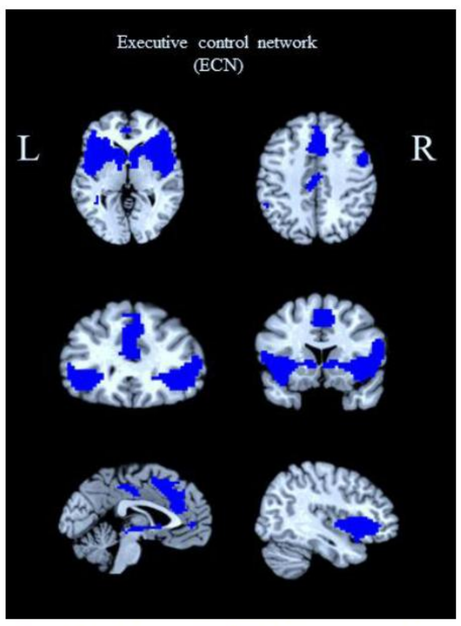

Figure 2. Spatial map of the ECN during cross-sex hormone treatment in female-to-males.
Included anatomical areas were the bilateral anterior and middle cingulate gyrus, bilateral insula, bilateral rolandic operculum, bilateral middle frontal gyrus, bilateral inferior frontal triangularis, operculum and orbital gyrus, bilateral caudate nucleus, bilateral putamen and bilateral supplementary motor area.

Methods

Resting state functional magnetic resonance imaging and sex hormone levels were analyzed in 21 female-to-males, 13 male-to-females, 17 untreated control men and 12 untreated control women (all participants were aged ≥ 17). Measurements were done at baseline, when endogenous gonadal stimulation in the transgender participants was suppressed by a gonadotropin-releasing hormone analogue, and four months after the start of cross-sex hormone treatment (testosterone in female-to-males and estradiol in male-to-females). Independent component analysis was used to evaluate the effect of cross-sex hormones.

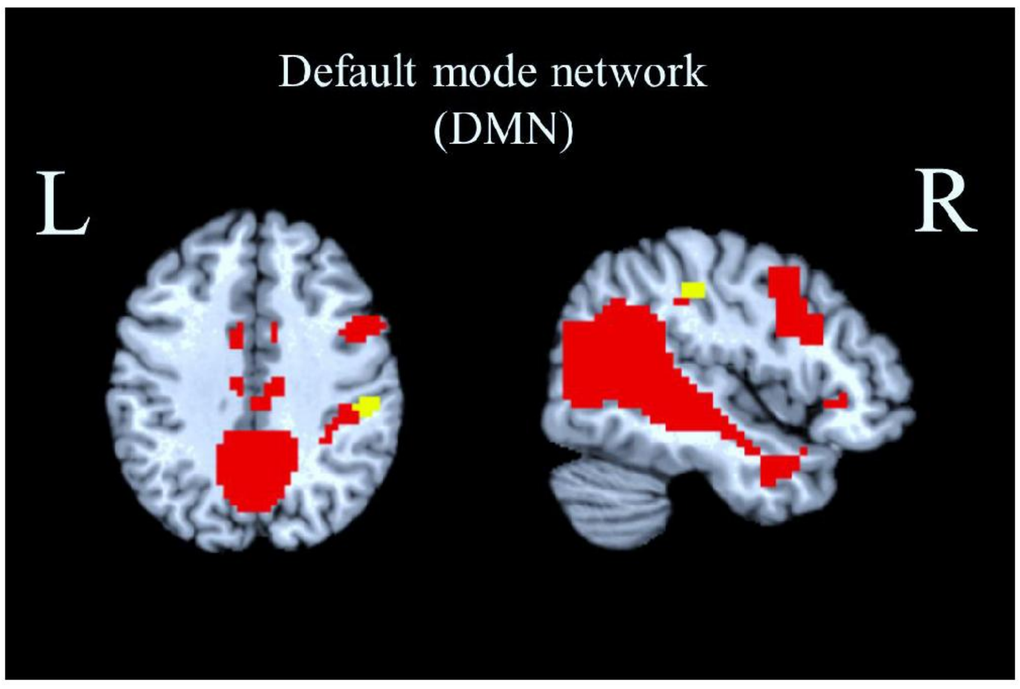

Figure 3. Significant difference in functional connectivity within the DMN after testosterone treatment in female-to-males
The yellow blob represents the area (right postcentral gyrus) within the DMN (red blobs, see also Figure 1) where functional connectivity after testosterone treatment was significantly higher as compared to baseline (peak difference at 51, -28, 41).

Results

For the default mode network, the female-to-males showed increased functional connectivity between the right postcentral gyrus and other parts of this network four months after start of cross-sex hormone treatment (peak t-value = 5.9, kE = 19, $p < 0.001$; see Figure 3) as compared to baseline. In contrast to the default mode network, functional connectivity in the executive control network did not change. In the other study groups (male-to-females and controls) functional connectivity in both the default mode network and executive control network remained stable between the two scan sessions.

Conclusion

Functional connectivity within the default mode network appears to be affected by testosterone treatment in female-to-male transgender persons.

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