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Is parental overcontrol a specific form of child maltreatment? Insights from a resting state EEG connectivity study

Giuseppe A. Carbone [a], Claudio Imperatori [b], Mauro Adenzato [a,*], Aurelia Lo Presti [a], Benedetto Farina [b], Rita B. Ardito [a]

[a] *Department of Psychology, University of Turin, Turin, Italy*
[b] *Cognitive and Clinical Psychology Laboratory, Department of Human Sciences, European University of Rome, Rome, Italy*

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ABSTRACT

Introduction: Recent studies suggest that parental overcontrol could be considered a specific form of childhood trauma (CT). Although previous research has shown that CT alters the functional and structural architecture of large-scale networks in the brain, the neural basis associated with parental overcontrol has not been sufficiently explored. Therefore, the main aim of the current study was to investigate the relationship between parental overcontrol and electroencephalography (EEG) triple network (TN) functional connectivity during the resting state (RS) condition in a non-clinical sample ($N = 71$; 39 females, mean age 23.94 ± 5.89 SD).
Methods: EEG was recorded during 5 min of RS with eyes closed. All participants were asked to self-report maternal and paternal overcontrol, CT and general psychopathology. All EEG analyses were performed using the exact low-resolution electromagnetic tomography software (eLORETA).
Results: Our results showed a significant positive correlation between maternal overcontrol and theta connectivity between the salience network and the central executive network. This connectivity pattern was independently associated with maternal overcontrol even when controlling for relevant confounding variables, including the severity of CT and the general level of psychopathology. This neurophysiological pattern may reflect a predisposition to detect and respond to potentially threatening stimuli in the environment, which is typically associated with excessive overcontrol.
Conclusions: Our findings support the hypothesis that parental overcontrol should be considered a form of CT in all respects independent of the forms traditionally studied in the literature (i.e., emotional abuse, physical abuse, sexual abuse, and physical and emotional neglect).

1. Introduction

In recent years, the construct of Childhood Trauma (CT) has attracted particular clinical and research interest. It has been defined as the repeated and prolonged stressful experiences and overwhelming events within the caregiver relationship (Farina et al., 2019; Massullo et al., 2023). Specifically, CT is a multidimensional construct that encompasses diverse and severe forms of maltreatment, such as physical, sexual, and emotional abuse, as well as physical and emotional neglect (McLaughlin & Lambert, 2017). According to previous studies, these adverse childhood experiences are considered one of the most important risk factors for the development of

* Corresponding author.
E-mail address: mauro.adenzato@unito.it (M. Adenzato).

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psychopathology across the lifespan including post-traumatic stress disorder (PTSD), anxiety, depression, disruptive behaviors, and addictive disorders (Massullo et al., 2023; McLaughlin & Lambert, 2017).

Although the role of CT in the development of psychopathology has been widely demonstrated, recent studies suggest that the current literature does not consider and include some specific forms of child maltreatment such as parental overcontrol (De Rossi et al., 2023; Farina et al., 2021; Massullo et al., 2023; Şar et al., 2021; Wu et al., 2022). Parental overcontrol can be defined as a repeated and prolonged behavioral pattern of overprotection and intrusion by parental figures (i.e., maternal/paternal) that is associated with a significant restriction of the child's age-appropriate autonomy and independence (Parker et al., 1979). Similar to emotional abuse, parental overcontrol exposes the child to a world that is portrayed and thus perceived as threatening, and to a self-image as fragile and at risk (De Rossi et al., 2023; Farina et al., 2021). This parenting style is expressed through explicit or indirect attempts to influence or restrict the child's emotions and cognition (Bögels & Brechman-Toussaint, 2006). More specifically, such behaviors in moment-to-moment interactions can be either preventive (i.e., overrepresentation of potentially dangerous future situations to avoid the child's discomfort) or reactive (i.e., physical and emotional distance, punishment or criticism; Borelli et al., 2015), resulting in the child's constant state of alarm and danger, characterized by high levels of affective vulnerability (Farina et al., 2021; Perlman et al., 2022). As a result, children show greater psychobiological sensitivity to context (Hastings et al., 2019), which increases the risk of psychopathology across the lifespan, especially depression (Şar & Türk-Kurtça, 2021).

Indeed, it is well known that the interaction between the child and the parental figures not only affects the child's cognition, emotion and affectivity (Bögels & Brechman-Toussaint, 2006; Farina et al., 2021) but also influences and shapes neural functioning, especially brain connectivity (Carbone et al., 2024; Choi et al., 2021; Massullo et al., 2022). Accordingly, several studies showed that child maltreatment alters the brain's functional and structural architecture of large-scale networks involved in higher-order cognitive processes, such as emotional regulation and mentalization (Cassiers et al., 2018; Farina & Imperatori, 2023; Teicher et al., 2016). Despite this, the neural underpinnings concerning parental overcontrol have been relatively understudied.

To the best of our knowledge, only one study has investigated the neural pattern associated with parental overcontrol. Adenzato et al. (2019), in an electroencephalography (EEG) study, reported a negative correlation between maternal overcontrol and default mode network (DMN) functional connectivity after the activation of attachment memories, suggesting a transient alteration in higher-order mental functions (e.g., mentalization). Thus, although some data on the neurophysiological underpinning of parental overcontrol in the domain of intra-network connectivity (Adenzato et al., 2019) can be found in the current scientific literature, to date no studies investigated this specific CM dimension adopting an inter-network functional connectivity perspective. In this context, the triple network (TN) model (Menon, 2011) has recently been proposed to better understand different psychopathological and dysfunctional dimensions by investigating the functional and dynamic interactions between three main brain networks: the DMN, the salience network (SN), and the central executive network (CEN).

The DMN, often studied in resting state (RS) condition, is a brain network involved in higher-order cognitive processes such as mentalization, emotion regulation, autobiographical memory, and self-awareness (Raichle, 2015). The main nodes are the posterior cingulate cortex (PCC) and the medial prefrontal cortex (mPFC; Andrews-Hanna, 2012). In contrast, the CEN, also known as the "fronto-parietal network", comprises the dorsolateral prefrontal cortex (dlPFC) and the posterior parietal cortex (PPC). It is involved in top-down cognitive functions during emotional, attentional, and cognitive processing, including working memory, decision-making, and goal-directed tasks (Koechlin & Summerfield, 2007; Miller & Cohen, 2001; Petrides, 2005). Lastly, the SN, with key hubs in the dorsal anterior cingulate cortex (dACC) and the bilateral anterior insula (AI), plays a crucial role in detecting, processing, and integrating relevant information (Seeley et al., 2007). It is engaged in switching between DMN and CEN, and it regulates general access to cognitive functions and shifts of attention from endogenous to exogenous events, whereas specific functional alterations in SN hubs are often identified in different psychopathological dimensions (Sridharan et al., 2008).

Therefore, to extend the current literature, the main aim of the current study was to investigate the association between parental overcontrol and RS-TN functional connectivity in a non-clinical sample using the EEG. Although functional magnetic resonance imaging (fMRI) is commonly used to investigate brain connectivity, the EEG is considered a suitable tool to assess the synchronization and the dynamics between and within networks (Liu et al., 2018).

According to the conceptualization of the SN as a neural system critically involved in internal/external threatening stimuli detection, we hypothesized that high levels of parental overcontrol would be positively associated with increased RS-EEG connectivity among SN hubs, even after controlling for potential confounding variables, including CT severity.

2. Materials and methods

2.1. Participants

Based on a previous study (Adenzato et al., 2019), reporting a negative correlation (i.e., $r = 0.33$) between the overcontrol severity and EEG functional connectivity within DMN, an a priori power analysis (G*Power 3.1 software) was performed using the following criteria: statistical power ($1 - \beta = 80$ %) with an α-error probability of 0.05 and an effect size of 0.33. According to the power analysis, a sample of at least 67 individuals, in a two-sided test correlational model, was required to achieve satisfactory statistical power.

This work is part of a larger research project still in progress. Specifically, in this study, 71 participants were recruited (39 females 54.9 % and 32 males 45.1 %; mean age 23.94 ± 5.89 SD). The following inclusion criteria were applied: i) individuals ≥18 years of age; ii) individuals with a comprehensive understanding of the Italian language. Participants were excluded if they i) had a history of neurological or psychiatric disease or head injury; ii) were left-handed in line with Laterality Quotient < of 61 (Veale, 2014); iii) had consumed substances with an active effect on the central nervous system within two weeks prior to the study. The ethics review committee of the University of Turin evaluated and approved the study procedure in accordance with the principles of the Helsinki Declaration (protocol n. 0243029).

2.2. Experimental procedure and questionnaire

All participants underwent the same experimental procedure. Firstly, they fulfilled the exclusion/inclusion criteria via an online form, secondly, a battery of questionnaires including both clinical [i.e., the Overcontrol subscale of the Measure of Parental Style (MOPS, Parker et al., 1997) the Childhood Trauma Questionnaire - short form (CTQ-SF; Bernstein et al., 2003), and the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983)] and sociodemographic variables was administered (i.e., age, sex, tobacco and alcohol use). Later, in the following week, all participants underwent EEG acquisition.

The overcontrol subscale of the MOPS (Parker et al., 1997) consists of 8 items that assess the level of maternal (4 items) and paternal (4 items) psychological overprotection, intrusion and restriction of autonomy and independence. Each item is rated on a 4 Likert point scale (from 0 to 3), with higher scores indicating higher maternal and or paternal overcontrol. For the present study the Italian version was used (Picardi et al., 2013), and the Cronbach's alpha was 0.776 and 0.667 for the paternal and maternal subscale, respectively. Although the reliability coefficient for maternal overcontrol subscale is slightly below the conventional threshold of 0.70, it should be noted that a low alpha value does not necessarily indicate poor reliability, especially in the case of a subscale with few items (Schmitt, 1996). In addition, Cronbach's alpha values >0.64 are considered adequate by some researchers (e.g., Robinson et al., 1991; Taber, 2018).

The CTQ-SF (Bernstein et al., 2003) is composed by 28 items rated on a 5 Likert point scale (from 1 = never to 5 = very often). It is a widely used self-report measure to assess the different dimensions of CT. More specifically, the CTQ-SF investigates the following 5 forms of maltreatment: emotional abuse, physical abuse, sexual abuse and physical and emotional neglect. A higher CTQ total score indicates a higher level of traumatic childhood experiences. This self-report also includes an additional 3-item scale, the so-called Minimization/Denial scale (M/D), designed to assess the possible underestimation of maltreatment. The Italian version of the CTQ–SF was used (Sacchi et al., 2018) and the Cronbach's alpha in the present sample was 0.886 for the total score and 0.885 for the M/D subscale.

Finally, the BSI (Derogatis & Melisaratos, 1983) was used to assess the general level of psychopathology. The BSI consists of 53 self-reported items assessing 9 different clinical dimensions: somatization, obsession–compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The measure of general level of psychopathology, i.e., the global severity index (GSI), is calculated using the sums for the 9 symptom dimensions. The Italian version (De Leo et al., 1993) was administered to all participants and the Cronbach's alpha for the GSI was 0.957.

2.3. EEG analysis

All EEG recordings were performed in the RS condition with eyes closed in a semi-dark room and lasted 5 min. Participants were asked to abstain from substances such as theine or caffeine in the 4 h prior to recording. EEG acquisitions were performed using a 62-channel headset (i.e., BrainAmp DC by Brain Products) and impedances were kept below 5 kΩ.

A post-processing was then applied to all EEG raw data using the EEGLAB toolbox for MatLab version 2022.1 (Delorme & Makeig, 2004). First, a visual inspection was performed to identify prominent and severe artifacts. A passband filter of 1–40 Hz was then applied and the average rereference was calculated. To identify and remove the primary artifacts, including electrical, muscular, and visual deflections, an Independent Component Analysis (ICA) was also executed using the infomax decomposition algorithm.

The connectivity analysis were performed using the exact Low-Resolution Electromagnetic Tomography software (eLORETA; Pascual-Marqui et al., 2011), a validated tool for the investigation of electrocortical activity and large-scale brain network (Pascual-Marqui et al., 2011). Using a three-dimensional (3D), linear, distributed non-inverse norm solution, it provides an exact localization of the neural sources albeit with a low spatial resolution (Canuet et al., 2012). Based on magnetic resonance image (MRI) data-set, the potential electric field computed with the boundary element method are used for the inverse solution head model (Fuchs et al., 2002).

Table 1
Triple network eLORETA ROIs and Montreal Neurological Institute coordinates.

Brain network	Anatomical structure	eLORETA MNI coordinates		
		x	**y**	**z**
DMN	mPFC	0	55	25
	PCC	0	-55	20
	dACC	0	20	35
SN	lAI	−45	15	−5
	rAI	50	15	−5
CEN	ldlPFC	−45	20	35
	rdlPFC	40	25	50
	lPPC	−40	−70	45
	rPPC	50	−60	40

Abbreviations: eLORETA: exact Low-Resolution Electromagnetic Tomography software; **MNI**: Montreal Neurological Institute coordinates; **CEN, SN, DMN ROIs.**

Particularly, the eLORETA software uses a realistic head model based on several MNI152 templates provided by the Brain Imaging Center of the Montreal Neurological Institute (MNI; Mazziotta et al., 2001). The source localization agreement with other neuroimaging techniques has been widely demonstrated also when using a small number of electrodes (i.e., <30, De Ridder et al., 2011; Huang et al., 2018; Kirino, 2017; Müller et al., 2005).

Considering the high temporal resolution, the eLORETA software is thus a useful tool in the investigation of large-scale brain networks providing a direct measurement of the postsynaptic changes in specific frequency bands (Thatcher et al., 2014).

Following the recent guidelines of Miljevic et al. (2022), artifact-free data were segmented in 4 s epochs and, in order to perform the connectivity analysis within the TN, 9 different regions of interest (ROIs) have been defined according to eLORETA previous studies (Carbone et al., 2022; Imperatori et al., 2020; Li et al., 2018; Massullo et al., 2020). All the ROIs MNI coordinates are reported in Table 1. In detail, the lagged phase synchronization (LPS), a widely used connectivity index, was used to calculate the synchronization within the TN. In this line, the LPS aims to reduce artifacts like volume conduction excluding the instantaneous zero-lag influence (Pascual-Marqui, 2007). In detail, it evaluates the signal similarity in frequency domains using normalized Fourier transform, where values range from 0 (indicating no synchronization) to 1 (maximum synchronization) moreover, compared to other connectivity indexes the LPS is minimally affected by spatial resolution (Hata et al., 2016).

Finally, according to previous studies (Canuet et al., 2011), the "single nearest voxel" option in the eLORETA program for source reconstruction was used, wherein each region of interest (ROI) consists of a single voxel closest to each seed. All connectivity analysis were performed considering different frequency bands (delta 0.5–4 Hz, theta 4.5–7.5 Hz, alpha 8–13 Hz, beta 13.5–30 Hz).

2.4. Statistical analysis

To explore the relation between TN connectivity data and both maternal and paternal overcontrol, two separate regression analyses were performed using the "regression option" included in the eLORETA software. Specifically, the overcontrol scores were correlated with each TN ROIs for each frequency band (i.e., delta, theta, alpha and beta). To address the issue of multiple comparisons (i.e., comparisons between all ROIs for each frequency band), the statistical nonparametric mapping method (SnPM) integrated into the eLORETA software package was used (for technical detail see,Hata et al., 2016; Nichols & Holmes, 2002). Briefly, the SnPM ensures that the reported results are robust and are not inflated by the large number of comparisons generating an empirical probability distribution of the maximal statistics under the null hypothesis (Hata et al., 2016; Nichols & Holmes, 2002). It uses a non-parametric permutation with 5000 randomizations to determine the critical probability threshold for *r*-values, that corresponded to statistically corrected *p*-values (e.g., $p < .05$ and $p < .01$).

Finally, for sensitivity analysis, considering the non-normal distribution of several variables (i.e., absolute values for asymmetry and kurtosis >2.0, George, 2011; Hair et al., 2021), the association between both CTQ-SF and GSI-BSI total score with any significant connectivity data detected by the eLORETA software was investigated using the Spearman's correlation coefficient (*rho*).

Lastly, to investigate the independent role of overcontrol on significant EEG connectivity data, a multiple linear regression analysis was performed. Specifically, according to the results of the bivariate eLORETA analysis, EEG connectivity values were set as the dependent variable and paternal and/or maternal overcontrol as the independent variable. Potential confounding clinical (i.e., GSI – BSI, CTQ total score and M/D subscale) and sociodemographic variables (i.e., age, sex, tobacco and alcohol use) were also included in the model (Liu et al., 2022; Menon, 2011; Stacey et al., 2021). Assumptions on multiple regression model were controlled according to Williams et al. (2019).

All statistical analysis was performed using SPSS version 21 (Statistical Package for the Social Sciences).

3. Results

Sociodemographic and clinical variables are reported in Table 2. The eLORETA significance thresholds, adjusted for multiple comparisons, were $r = \pm 0.440$ for $p < .01$ and $r = \pm 0.399$ for $p < .05$ for the maternal overcontrol regression and $r = \pm 0.472$ for $p < .01$ and $r = \pm 0.411$ for $p < .05$ for the paternal one[1]. No significant association between TN connectivity and paternal overcontrol subscale was found. Specifically, in this analysis the value closer to statistical significance was observed in the beta band between left dlPFC and left AI ($r = 0.307$, $p = .471$).

A significant positive correlation was found between the MOPS maternal overcontrol subscale and theta TN connectivity ($r = 0.405$, $p = .039$), between the left dlPFC and right AI (Fig. 1). No other significant associations were detected by the eLORETA software in the other frequency bands.

The connectivity between the left dlPFC and the right AI was associated with the CTQ-SF total score ($rho = 0.320$, $p = .006$), but not with the BSI-GSI ($rho = 0.065$, $p = .588$).

The assumptions of the regression model were all satisfied, with the exception of the heteroskedasticity of the data. Therefore, according to Flachaire (2005) and Williams et al. (2019), a wild bootstrap procedure was performed with 5.000 samples. All results of the regression model are shown in Table 3. Specifically, the model explained 22 % of the variance in EEG connectivity ($F_{8;62} = 2.171$, $p = .042$). Maternal overcontrol was independently associated with connectivity values ($B = 24.728$, $p = .020$). No other significant associations were reported.

[1] One participant was not able to complete paternal overcontrol subscale of the MOPS (i.e., paternal early death); thus, in this analysis the sample size was $N = 70$

Table 2
Sociodemographic and clinical variables.

Variables	
Age M ± SD	23.94 ± 5.89
Female N (%)	39 (54.9 %)
Tobacco use N (%)	27 (38 %)
Alcohol use N (%)	67 (94.4 %)
Maternal Overcontrol M ± SD, (range = 0–12)	4.92 ± 3.01
Paternal Overcontrol M ± SD, (range = 0–12)	3.36 ± 3.08
CTQ total score M ± SD, (range = 25–125)	41.34 ± 11.60
CTQ M/D subscale M ± SD, (range = 3–15)	8.18 ± 3.14
GSI-BSI total score M ± SD (range = 0–4)	1.12 ± 0.65

Abbreviations: **M:** mean; **SD**: standard deviation; **CTQ**: Childhood Trauma Questionnaire; **CTQ M/D**: Minimization/Denial subscale; **GSI-BSI**: Global Severity Index of the Brief Symptoms Inventory.

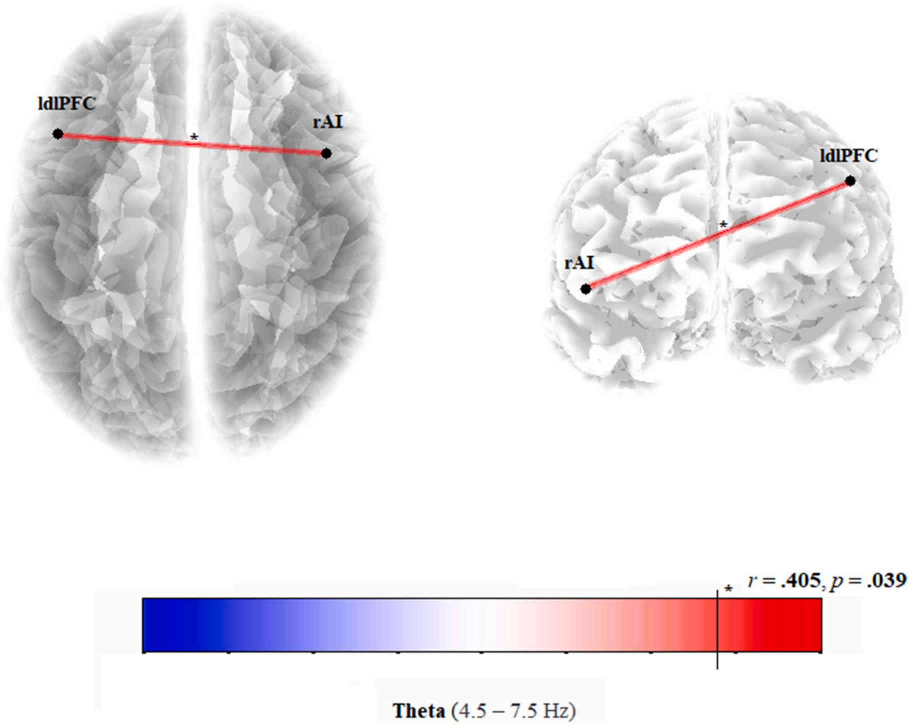

Fig. 1. eLORETA connectivity result.
Note. Results of eLORETA functional connectivity in the theta frequency band. The red line indicates increased EEG functional connectivity between the left dorsolateral prefrontal cortex (ldlPFC) and the right anterior Insula (rAI). The correlational values (r) for statistical significance (p) are shown at the bottom of the figure. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4. Discussion

To our knowledge, this was the first study investigating the association between EEG RS TN functional connectivity and parental (i.e., maternal and paternal) overcontrol in a non-clinical sample. Although no significant association was observed for paternal overcontrol, our results showed a significant positive correlation between maternal overcontrol and increased theta connectivity between the SN (i.e., the right AI) and the CEN (i.e., the left dlPFC). On a bivariate level, this connectivity pattern was also associated with the CTQ-SF total score, but not with the general level of psychopathology. Importantly, at the multivariate level, the association between maternal overcontrol and SN-CEN theta connectivity remained significant even when controlling for relevant confounding variables, including CT severity, suggesting that maternal overcontrol is independently associated with altered communication between SN and CEN during RS.

While the SN is critically involved in detecting, processing, and integrating relevant environmental stimuli, including threatening information (Seeley et al., 2007), the CEN plays a crucial role in top-down cognitive functions during emotional, attentional, and

Table 3
Wild bootstrap linear regression analysis in all the sample (N = 71).

Dependent Variable	R^2	$F_{8;62}$	Independent Variables	B	p	[95 % CI]	
ldlPFC - rAI theta connectivity	0.22	2.171			0.042	Lower	Upper
			Sex	23.228	0.628	−59.931	108.729
			Age	2.825	0.678	−3.844	9.514
			Tobacco use	−58.994	0.188	−135.905	16.322
			Alcohol use	−83.317	0.430	−231.476	70.021
			BSI – GSI	−32.156	0.297	−87.855	21.469
			CTQ total score	3.275	0.277	−1.816	8.377
			CTQ (M/D)	7.736	0.552	−14.413	29.677
			Maternal overcontrol	**24.728**	**0.020**	**5.426**	**43.838**

Note: In bold significant variables associated with EEG connectivity data.
Abbreviation: **ldlPFC**: left dorsolateral prefrontal cortex; **rAI**: right anterior Insula; **B**: Unstandardized Beta; **BSI – GSI**: Brief Symptom Inventory – Global Severity Index; **CTQ**: Childhood Trauma Questionnaire; **CTQ (M/D)**: Childhood Trauma Questionnaire Minimization/Denial subscale.de

cognitive processing, such as working memory, decision-making, planning and goal-directed tasks (Koechlin & Summerfield, 2007; Miller & Cohen, 2001; Petrides, 2005).

In our study, the increased theta connectivity in the SN and CEN was observed between the right AI and left dlPFC. The insula is involved in various cognitive, affective, and regulatory functions, including interoceptive awareness, emotional and empathic processes, and is therefore widely known for detecting and identifying salient internal and external stimuli (Menon & Uddin, 2010; Singer, 2006; Uddin et al., 2017). To elucidate the complexity of the insula, recent studies have identified specific structural and functional areas of this brain region (Centanni et al., 2021; Uddin et al., 2017). In particular, although the right AI appears to be active during attention to internal body information (Critchley et al., 2004), its specific involvement in the anticipation and emotional experience of aversive stimuli has also been observed (Von Stein & Sarnthein, 2000). In this sense, recent studies reported a specific role of the AI in the anticipation of unpredictable versus predictable threats and in sustained versus transient anticipation (Alvarez et al., 2011; Ito & Lee, 2016; Robinson et al., 2019).

Increased functional connectivity between the insula and the dlPFC was also previously reported by Zhao et al. (2022). In particular, the authors suggest that the greater connection may reflect a top–down regulation from the dlPFC to the AI aimed at reducing anticipatory anxiety responses. In this context, the role of the dlPFC in preparation of forthcoming actions and decision-making has also been demonstrated in the literature (Pochon et al., 2001). Based on our findings, it is therefore possible that the relationship between maternal overcontrol and increased theta connectivity might reflect a predisposition to detect (i.e., SN) and respond to (i.e., CEN) potentially threatening stimuli in the environment.

It is noteworthy that our result was observed in the theta frequency band. Specifically, theta synchronization is not considered the dominant neural activity during RS (Filosa et al., 2024; Xing et al., 2017) and its abnormal increase during this condition has been reported in several psychopathological pictures (Perrottelli et al., 2021). Thus, it is possible that the heightened sensitivity in detecting salient stimuli and consistent preparation for responding lead to enhanced top-down cognitive regulation supported by sustained long-range synchronization of brain networks such as SN and CEN (Von Stein et al., 2000) and long-range theta connectivity (Mizuhara et al., 2004; Sauseng et al., 2005). Interestingly, while maternal and paternal behaviors (i.e., overcontrol, overprotection, over-involvement, autonomy granting, challenging parenting) have been shown to play the same role in the development of anxiety in children (Möller et al., 2016), our data seem to suggest that the specific dynamic alteration in functional theta connectivity between regions of the SN and CEN in the non-clinical population is only associated with maternal overcontrol, indicating a specific neuro-physiological underpinning of this form of CM. However, it is important to emphasize that our findings are consistent with the only previous report examining the relationship between EEG functional connectivity and parental overcontrol. Indeed, Adenzato et al. (2019) observed a specific change in brain functional connectivity only for the maternal overcontrol subscale, but not for the paternal one.

When interpreting the results of the present study, some specific limitations should be considered. First, the functional connectivity of the triple network was investigated using EEG, which is known to have limited spatial resolution. Second, although general psychopathology and individual parental style were assessed using self-report measures (which have statistical and social desirability limitations), no clinical interview was conducted with participants. Finally, we examined the relationship between parental overcontrol and functional EEG connectivity only in a non-clinical sample and in the RS condition with eyes closed. Future studies should therefore extend the existing literature and investigate the current research topic in clinical populations and examine the neural changes before and after the administration of stimuli with high emotional value, such as attachment-related memories.

Despite these limitations and in line with the original proposal by Bowlby (1977) and more recent studies (De Rossi et al., 2023; Massullo et al., 2023; Şar et al., 2021; Wu et al., 2022), the relevance of our findings is that they seem to support the hypothesis that parental overcontrol should be considered in all respects as a form of CT that is independent of the forms traditionally studied in the literature (i.e., emotional abuse, physical abuse, sexual abuse, and physical and emotional neglect). This consideration could help clinicians and researchers to better understand the etiopathogenetic processes underlying the development of several clinical pictures associated with this form of parenting style.

CRediT authorship contribution statement

Giuseppe A. Carbone: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Claudio Imperatori:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Mauro Adenzato:** Writing – original draft, Supervision, Methodology, Conceptualization, Data curation, Writing – review & editing. **Aurelia Lo Presti:** Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing. **Benedetto Farina:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Rita B. Ardito:** Conceptualization, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing.

Data availability

Data will be made available on request.

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