



Received: 3 April 2023 | Revised: 16 June 2023 | Accepted: 22 July 2023

DOI: 10.1002/erv.3016

BRIEF REPORT

WILEY

Look me in the eyes! A preliminary study on eye-contact in adolescents with anorexia nervosa

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Handling Editor: Nadia Micali**Funding information**

Friedrich-Baur-Stiftung

Abstract

Objective: Anorexia nervosa (AN) is often associated with impairments in the socio-emotional domain. Avoidance of eye-contact may underlie some of these difficulties and has been found in adults with AN in several studies. This study aimed to clarify whether adolescents with AN also show reduced eye-contact when viewing social stimuli, that is, faces.

Methods: In this cross-sectional study, girls aged 12–18 years with AN ($n = 38$) were compared with a clinical (girls with depression and/or anxiety disorders; $n = 30$) and a healthy ($n = 36$) control group. Eye-contact was operationalised as maintenance of visual attention to the eye-area of faces showing different emotional expressions (happy, angry, afraid, sad, neutral), recorded via eye-tracking.

Results: Contrary to our expectations, we did not find adolescents with AN to dwell less on the eye-area than control groups; instead, we found preliminary evidence for increased attention to the eye-area in the AN group compared to the healthy control group.

Conclusions: The results suggest that reduced eye-contact found in adult AN samples is not (yet) present in adolescents with AN but may develop with the prolonged duration of the disorder. However, replication and longitudinal studies are needed to confirm this assumption.

KEYWORDS

adolescents, anorexia nervosa, emotional faces, eye-contact, eye-tracking

Highlights

- This is the first study to investigate eye-contact (operationalised as visual attention to the eye-area) in adolescents with anorexia nervosa compared to a healthy and a clinical control group.
- Adolescents with anorexia nervosa did not show reduced eye-contact.
- Reduced eye-contact may develop with prolonged illness duration.

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1 | BACKGROUND

Anorexia nervosa (AN) is characterised by significantly low body weight, severe fear of weight gain, and disturbed body image (American Psychiatric Association, 2013) and is often associated with socio-emotional impairments (Tauro et al., 2022). These impairments have been proposed to be involved in the disorder's development and maintenance (e.g., Treasure & Schmidt, 2013), as they may not only aggravate interpersonal difficulties but also exacerbate eating disorder pathology as a maladaptive response to these difficulties (Treasure et al., 2012).

Avoidance of eye-contact may underlie some of the socio-emotional difficulties, as eye-contact is an important foundation for several socio-emotional skills, such as recognising emotions in other people's faces (Kerr-Gaffney et al., 2021; Kleinke, 1986), and has previously been associated with the severity of social difficulties (Corden et al., 2008). Some empirical studies of adults with AN have found them to show less eye-contact (operationalised as visual attention to the eye-areas of facial stimuli; Harrison et al., 2019; Watson et al., 2010) than adults without mental illness. However, no studies have investigated eye-contact in adolescents with AN. This seems particularly important as adolescence is the most common time for the onset of AN (Solmi et al., 2022) and is also a sensitive period for social development (Blakemore & Mills, 2014). Thus, impairments in socio-emotional skills during this period could have particularly detrimental consequences. In addition, while some alterations in socio-emotional processing, such as reduced attention to faces, have been found in both adults (Kerr-Gaffney et al., 2021; Watson et al., 2010) and adolescents (Pinhas et al., 2014; Sfarlea et al., 2023), others, such as deficits in facial emotion recognition, have been found to characterise only adults (Caglar-Nazali et al., 2014) but not adolescents with AN (Laghi et al., 2015; Sfarlea et al., 2018) and have been suggested to develop with the longer course of the illness. This emphasises the need to examine adolescents with AN separately regarding their socio-emotional skills, and in particular eye-contact, in order to find out whether difficulties in eye-contact are already present at an early stage of the disorder or develop as the disorder progresses.

The aim of the present study, therefore, was to investigate eye-contact in adolescents with AN. Eye-contact was operationalised as maintaining visual attention on the eye-area of faces showing different emotional expressions and was assessed using eye-tracking. When examining adolescents with AN, it is crucial to consider

that the majority have comorbid disorders, especially depression and anxiety disorders (Catone et al., 2021), both of which are associated with alterations in eye-contact (Capriola-Hall et al., 2021; Hinchliffe et al., 1971). Thus, transdiagnostic features may account for decreased eye-contact in AN. To distinguish between transdiagnostic and eating-disorder-specific alterations regarding eye-contact, adolescents with AN were compared not only with a healthy control (HC) group but also with a clinical control (CC) group consisting of adolescents with major depression and/or anxiety disorders.

In line with prior findings in adults (Harrison et al., 2019; Watson et al., 2010), we hypothesised that adolescents with AN would dwell less on the eye-area of emotional faces compared to HCs. No predictions were made for the CC group due to heterogeneous results regarding the direction of their eye-contact alterations and the lack of previous studies comparing AN and CC groups. Furthermore, we explored whether differences in eye-contact were modulated by facial emotion, as individuals with AN have been found to avoid certain emotional expressions (e.g., angry faces; Sfarlea et al., 2023).

2 | METHODS

Data for the present study were collected within a larger research project (Sfarlea et al., 2021). Ethical approval was obtained from the local Ethics Committee.

2.1 | Participants

A total of 112 girls were tested between September 2020 and March 2022, but $n = 8$ of them were excluded due to poor eye-tracking data quality (see below), resulting in a final sample of $N = 104$ 12–18-year-old girls. Participants in the two clinical groups were recruited at the Department of Child and Adolescent Psychiatry of the LMU University Hospital Munich and participants of the HC group were recruited via previous studies. Participants received a €30 voucher as compensation.

For all participants, past and previous psychiatric diagnoses according to DSM-5 (American Psychiatric Association, 2013) were assessed with a standardised semi-structured interview (Kinder-DIPS; Margraf et al., 2017; Schneider et al., 2017). Depressive symptoms were assessed with the Beck Depression Inventory-II (BDI-II; Hautzinger et al., 2006), while eating psychopathology was assessed with the Eating Disorder Inventory (EDI-2;

Thiel et al., 1997), both with Cronbach's $\alpha \geq 0.90$ in the current sample. Inclusion criteria were (corrected-to-) normal vision, sufficient German language skills, $IQ > 85$ (assessed with CFT 20-R; Weiß, 2006; one participant scoring just below 85 was included nonetheless; this did not change the results), and no psychotic or bipolar disorders, or substance abuse.

Thirty-eight girls meeting the diagnostic criteria for AN were included in the AN group. Most of them qualified for a comorbid disorder, primarily depression ($n = 18$) and anxiety disorders ($n = 14$). Thirty girls meeting the criteria for major depression ($n = 23$), social phobia ($n = 18$), and/or generalised anxiety disorder ($n = 8$) and no history of eating disorders were included in the CC group. Thirty-six girls not meeting the criteria for any current or past mental disorder were included in the HC group. Participant characteristics are presented in Table 1.

2.2 | Procedure

2.2.1 | Stimuli

Stimuli comprised 80 photographs of male and female faces showing five different emotional expressions (happy, angry, afraid, sad, neutral). Pictures were taken from the Karolinska Directed Emotional Faces database (Lundqvist et al., 1998), presented in greyscale, and edited to show only the facial area (to remove distracting features). Mean luminance, contrast, and predefined area of interest did not differ between emotions.

2.2.2 | Experimental task

Participants viewed the stimuli at a 65 cm viewing distance on a 15-inch computer screen. Each trial began with a fixation cross underpinned by a scrambled image of a face, which had to be fixated for 1000 ms to start the trial. Subsequently, a face was presented on a black background for 5000 ms (following Watson et al., 2010). The task consisted of 16 trials per emotion category, presented in random order. Participants were instructed to fixate on the fixation cross and then to view the stimuli.

2.2.3 | Eye-tracking

Eye movements were registered from the dominant eye using an EyeLink 1000 Plus eye-tracker (SR Research) with a sampling rate of 1000 Hz. Eye movement events were detected using a velocity- and acceleration-based saccade detection method with fixations defined as stable (within 1° of visual angle) gaze positions lasting at least 60 ms (Fujiwara et al., 2017). Before starting the task, a calibration and validation procedure was conducted, allowing an average error of $<0.5^\circ$ and a maximum error of $<1^\circ$ of visual angle.

Trials with a total dwell time below 75% of the presentation time and participants with less than 75% valid trials (Skinner et al., 2018) or systematic calibration errors (identified by visual inspection) were excluded ($n = 8$).

TABLE 1 Demographic and clinical characteristics of the sample.

	AN $n = 38$ $M (SD)$	CC $n = 30$ $M (SD)$	HC $n = 36$ $M (SD)$	ANOVA	Post-hoc
Age (years)	15.48 (1.58)	16.63 (1.45)	15.70 (1.76)	$p = 0.012$	CC > HC = AN
IQ	103.53 (14.77)	107.97 (10.48)	111.75 (13.08)	$p = 0.029$	HC > AN
BMI	16.19 (1.39)	21.61 (4.07)	21.16 (3.06)	$p < 0.001$	CC = HC > AN
BMI SDS	-1.99 (0.79)	-0.03 (0.95)	0.21 (0.84)	$p < 0.001$	CC = HC > AN
% On psychiatric medication	21.05	23.33	-	-	AN = CC
BDI-II	24.97 (14.95) ^a	27.93 (11.71) ^b	2.19 (3.15)	$p < 0.001$	CC = AN > HC
EDI-2 (DT + B + BD*)	83.00 (22.93)	66.21 (21.16) ^c	42.78 (15.78)	$p < 0.001$	AN > CC > HC

Abbreviations: AN, anorexia nervosa; B, bulimia subscale of the EDI; BD, body dissatisfaction subscale of the EDI; BDI-II, Beck Depression Inventory II; BMI, body mass index; BMI SDS, body mass index standard deviation score; CC, clinical control; DT, drive for thinness subscale of the EDI; EDI-2, Eating Disorder Inventory 2; HC, healthy control; IQ, Intelligence Quotient; M , mean; SD , standard deviation.

^a $n = 37$.

^b $n = 27$.

^c $n = 28$.

*Sum of three eating disorder specific subscales (cf. Garner, 2004).

The mean percentage of dwell-time spent on the eye-area was used as an indicator of maintenance of attention on the eye-area and was derived separately for each emotion. Split-half-reliabilities of these indices were good (Spearman-Brown-corrected reliability 0.82–0.88).

2.3 | Data analysis

Data were analysed using SPSS 26. A 3 (GROUP) × 5 (EMOTION) mixed ANOVA (with Greenhouse-Geisser corrections where necessary) was conducted on percentage of dwell times, followed up by *t*-tests.

3 | RESULTS

The ANOVA yielded a significant main effect of EMOTION ($F_{3,53,356.28} = 8.032$, $p < 0.001$, $\eta_p^2 = 0.074$), with all groups dwelling shorter on the eye-area when viewing happy faces compared to all other emotional expressions ($t_s \geq 2.13$; $p_s \leq 0.036$; see Supporting Information S1 for details). The main effect of GROUP, ($F_{2,101} = 3.056$, $p = 0.051$, $\eta_p^2 = 0.057$) and the GROUP × EMOTION interaction ($F_{7,06,356.28} = 0.257$, $p = 0.971$, $\eta_p^2 = 0.005$) were non-significant. However, as the main effect of GROUP could be interpreted as a trend ($p = 0.051$), explorative post-hoc *t*-tests were conducted: These revealed that the AN group dwelled significantly longer on the eye-area than the HC group ($t_{72} = 2.3$, $p = 0.022$, $d = 0.5$,

$CI_{95\%} = [0.077; 1.006]$). Differences between AN and CC groups ($t < 1$) and between CC and HC groups ($t_{64} = 1.8$, $p = 0.076$, $d = 0.4$) were non-significant, with a tendency for CC participants to dwell more on the eye-area than HC participants (see Figure 1).

4 | DISCUSSION

The present study investigated eye-contact, operationalised as visual attention to the eye-area in a passive face-viewing task, in adolescents with AN compared to a clinical and a HC group. Contrary to our expectations, we did *not* find adolescents with AN to dwell less on the eye-area than controls; instead, we found preliminary evidence for *increased* attention to the eye-area in the AN group compared to the HC group.

Our results suggest that, contrary to adults, adolescents with AN do *not* show reduced eye-contact compared to adolescents without mental illness, irrespective of the faces' emotional expressions. This mirrors the results for facial emotion recognition, an ability found deficient in adults (Caglar-Nazali et al., 2014) but intact in adolescents with AN (e.g., Laghi et al., 2015; Sfarlea et al., 2018). Considering that eye-contact has been found to be related to facial emotion recognition (Kerr-Gaffney et al., 2021), the slightly *increased* attention to the eye-area in adolescents with AN might even be related to their superior emotion recognition ability reported in some studies (Lulé et al., 2014; Sfarlea et al., 2018).

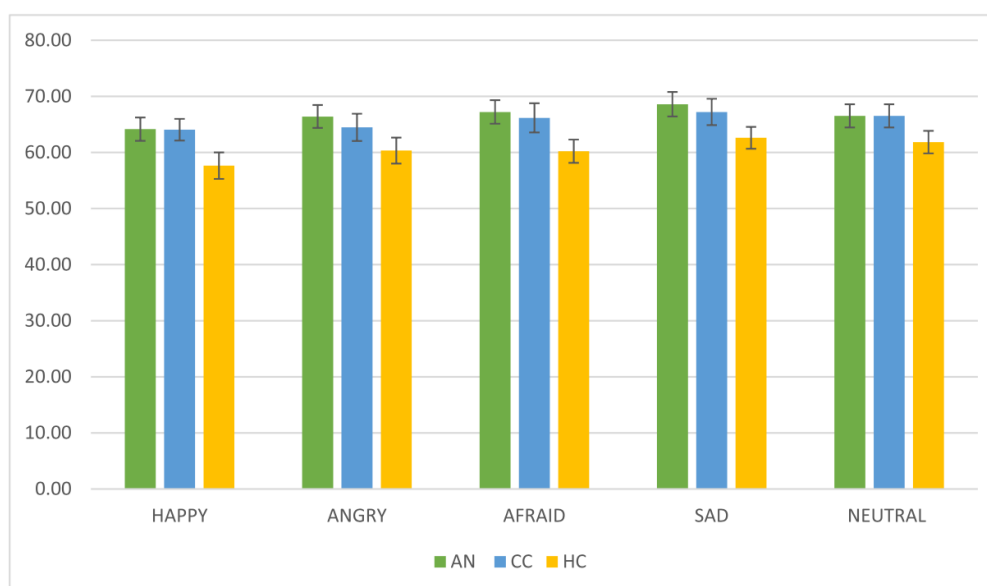


FIGURE 1 Mean percentage of dwell time on the eye-area of emotional faces among groups. AN, Anorexia nervosa, CC, clinical control, HC, healthy control. Error bars represent standard errors. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

However, excessive eye-contact could also indicate compensatory mechanisms for deficits in underlying processes in individuals with AN, such as weaker central coherence (Lang & Tchanturia, 2014) and cognitive processing inefficiencies (Lang et al., 2015), requiring increased attention to critical features to extract relevant information. Future studies should investigate the relationships between eye-contact, facial emotion recognition, and other socio-emotional skills to deepen our understanding of their interplay.

While there was no significant difference in the extent of eye-contact between the AN and CC groups in our study, there was a tendency for the CC group to also dwell more on the eye-area of faces than the HC group. Thus, it is also possible that the increased attention in adolescents with AN is explained by transdiagnostic factors such as fear of negative evaluation or vigilance to a perceived threat, especially since a considerable proportion of participants in both clinical groups (24% in the AN and 62% in the CC group) met criteria for social anxiety disorder, which has been found to be characterised by increased fixation on the eye-area of faces (Wieser et al., 2009). Future studies may aim to identify these transdiagnostic factors to better understand the processes underlying altered eye-contact in different mental disorders. Importantly, replication studies with larger samples are necessary, as the main effect of the ANOVA was not significant; therefore, the results of the post-hoc group comparisons should be interpreted with caution.

The absence of reduced eye-contact in adolescents with AN suggests that impairments in this social skill are not present at a relatively early stage of the disorder (illness duration in the current sample: median = 13 months, $M = 19.82$ months, $SD = 17.18$) but may only develop as the illness progresses and symptoms persist, similar to what has been suggested for facial emotion recognition abilities (Sfärlea et al., 2018). Interestingly, our results contrast those of a previous study (Sfärlea et al., 2023) that found reduced attention to faces in adolescents with AN. However, in that study, pictures of faces were presented alongside pictures of bodies, that is, disorder-related information. Together, these result patterns suggest that at an early stage of the disorder, individuals with AN might show reduced attention to social stimuli only in the presence of disorder-related information. At a later stage, this avoidance of social information might have generalised, occurring even in the absence of disorder-related information. However, these interpretations remain speculative, given the cross-sectional design of the present study. For future research, longitudinal investigations of socio-emotional skills in the course of AN or comparisons of

adolescents with AN (with relatively short illness durations) and adults with AN (with longer illness durations) are therefore strongly recommended to explore the role of illness duration. Furthermore, since we focused on economic and standardised stimuli, which may limit the ecological validity and transferability of our results to real-life, future studies should assess attention to the eye-area with more realistic (e.g., moving) stimuli to extend the results of our laboratory research.

5 | CONCLUSION

This is the first study to investigate eye-contact in adolescents with AN compared to adolescents with depression and/or anxiety disorders and healthy adolescents, using eye-tracking. Contrary to studies in adult samples (and our expectation), we did not find reduced eye-contact in adolescents with AN, indicating that eye-contact deficits may only develop with prolonged illness duration. Further (longitudinal) research is necessary to corroborate this assumption, replicate our findings, understand the interplay between eye-contact and emotion recognition, and identify factors underlying altered eye-contact in AN and other mental disorders.

AUTHOR CONTRIBUTIONS

Anca Sfärlea and Laura Nuding designed the study and developed the measures. Linda Lukas and Laura Nuding collected the data. Laura Nuding analysed the data and wrote the manuscript. Anca Sfärlea, Belinda Platt, and Gerd Schulte-Körne supervised the study and contributed to writing the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS

We thank Mia Althöfer for her assistance in preparing the study measures and materials, Petra Wagenbüchler, Veronika Jäger, and Carolina Silberbauer for their help with participant recruitment, and Victoria Puls, Anouk van Houdt, Laura Oßwald, as well as Verena Kellermann for collecting data. The present study was part of a project funded by Friedrich-Baur-Stiftung (Reg.-No. 60/20 to AS). The funder played no role in study design, data collection, analysis and interpretation of the data, or manuscript preparation.

Open Access funding enabled and organized by Projekt DEAL.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no competing interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CONSENT TO PARTICIPATE

Written consent was obtained from all participants (and their parents/legal guardians for participants younger than 18 years).

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How to cite this article: Nuding, L., Lukas, L., Platt, B., Schulte-Körne, G., & Sfarlea, A. (2024). Look me in the eyes! A preliminary study on eye-contact in adolescents with anorexia nervosa. *European Eating Disorders Review*, 32(1), 13–19. <https://doi.org/10.1002/erv.3016>

