

Research Summary

Background

Recent studies have provided evidence showing similar social orienting between young infants with and without autism (e.g., Jones & Klin, 2013), but yet a difference in engagement in social interactions, atypical fixation patterns to the face, and poor recognition of facial information (e.g., facial expressions) later on in life. The developmental cascade of worsening social behavior, including deficits in facial emotion recognition, seen in individuals with ASD start with early deficits in social attention. While emotion recognition develops early in childhood, young children with ASD experience more difficulty with recognition of certain expressions compared to their typically developing peers (Rump et al., 2009). While many studies have explored impairments in facial emotion recognition (FER) in individuals with ASD, more recently, research has focused on exploring the mechanism behind these impairments, utilizing eye-tracking in order to gain insights into the attentional processes. Results from prior studies suggest that individuals with ASD may have difficulties understanding others' emotions if they do not attend to the important facial features. In the current study, we developed and evaluated an attention modification paradigm to address FER deficits in children with ASD. The guiding aim was to alter the gaze patterns by highlighting the facial features which are important for FER.

The purpose of this study was to assess the feasibility of an attention modification intervention to attenuate deficits in facial emotion recognition and expression in individuals with ASD. The specific aims of this study were to (1) develop a novel attention modification paradigm for children with ASD; (2) assess the feasibility and acceptability of the attention modification intervention; (3) assess preliminary impact of the intervention on the target mechanism, change in facial emotion recognition; and (4) assess change in gaze to socially relevant cues following the intervention.

Organization, Design, and Methodology

Participants included a small sample of children (total $n = 8$) between the ages of 9 and 12, inclusive. In order to be eligible, all participants had to evidence difficulties with emotion recognition (based on parent report) and have at least low average intellectual abilities (IQ score greater than 75). In addition, participants were required to have received a formal diagnosis of ASD, which was confirmed by the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012). After providing assent (child) and parent permission (parent) for participation, all participants completed a series of measures and tasks evaluating child's facial emotion recognition, expression, and social skills. Following the intake appointment to determine eligibility, participants were randomized to complete a baseline assessment at home, consisting of either 4 time points, 5 time points, or 6 time points, before commencing intervention. FER during baseline and treatment periods were assessed using the EU-Emotion Stimulus Set specifically designed for children with ASD (O'Reilly et al., 2015). After the baseline period, participants began the intervention.

For the intervention portion, all participants attended 10 bi-weekly individual sessions, each one lasting approximately 20 minutes. In addition to the intake session, data were collected at the start of treatment (i.e., pre-treatment assessment) and at the end of treatment (i.e., post-

treatment assessment). Participants were compensated \$20 for completion of the intake, pre-treatment and post-treatment assessment sessions, in addition to \$20 for completion of all treatment sessions, for a maximum total of \$80 for completion of all assessments and treatments.

During the 10 treatment sessions, participants were seated in front of the eye tracking screen, and were shown the Intervention Task Stimuli consisting of 17 five-second videos of an actor or actors displaying an emotion, taken from movies and tv-shows. The faces of the actors in the video were surrounded by a square box (white dotted line) in order to draw attention to the socially relevant information (i.e., the social stimulus that conveys the target emotion). As the child proceeded through the 10 session program, the number of videos with a square box decreased so that for each subsequent session, the percentage of videos with the cue was less than in the prior session. Therefore, while in the first session all videos (100%) had the facial area highlighted, the last session included only two videos (12%) with the visual cue. As participants watched each video, they were instructed to attend to the video and were informed that they were going to be asked questions regarding the video after each presentation. At the end of the video, the participants were asked which emotion was displayed in the clip, with options presented in print on the screen. The participants verbally labelled the emotion. While viewing the stimuli, participants' eye gaze was recorded using a Tobii T60 XL eye-tracker, which tracked their eye-gaze in real time.

Outcomes

Our results show that the intervention is viable in terms of participant interest/enrollment and family satisfaction, but the impact on clinical outcome is less clear. After only one drop due to difficulty commuting a long distance to the center, 8 participants fully completed the paradigm and no baseline or treatment sessions were missed for any of the participants. While we were successful at recruiting the projected 8 participants, the recruitment period was much longer than anticipated, with the recruitment spread over 10 months. For the participants who completed the study however, all but one child rated the program to be acceptable in terms of time and commitment and all parents noted that the program is acceptable. Similarly, for all other items on the treatment satisfaction forms, both parents and children provided neutral or positive ratings regarding liking the program, the program being helpful, and recommending the program to a friend, and therefore, overall, based on parent and child satisfaction, the developed attention paradigm is seen as acceptable to the families.

In terms of the impact of this attention retraining intervention on FER, results are mixed. While we hypothesized that there would be a significant improvement in participants' FER ability from pre to post intervention, the results are not consistent across the different measures we used to assess FER ability. For the only standardized and normed measure of FER utilized in this study (AR subtest of NEPSY-II), only one participant showed a reliable increase in FER score. Importantly however, this participant was the only child in the study that scored below average on this measure prior to the intervention. All other participants scored in the average or above average range prior to the intervention, and therefore ceiling effects may have impacted ability to see movement on this measure. However, taking parent's report of their child's ability to recognize emotions following the intervention, five out of the eight parents noted slight increase in their child's FER, indicating potential positive impact of the intervention on FER from the parent's perspective.

Secondary to its impact on FER abilities, we aimed to explore preliminary impact of the attention retraining intervention on more general outcome measures, including social skills. Interestingly, all eight subjects showed a decrease in the Social Responsiveness Scale total score, indicating decreased social impairment; however, the decrease was reliable for only two of the participants. Similarly, a decrease in problem behaviors was seen on the Child Behavior Checklist measure for three of the participants, even though no participants showed a decrease on the social subscale, indicating more general decrease in problem behaviors outside of social skills. In addition, decrease in alexithymia was observed for two participants, showing changes for some participants on both parent and child measures. The most consistent outcome observed was for the two measures that parents completed at each treatment session over the five weeks. For the Emotion Regulation and Social Skills Questionnaire measure, which detects emotion recognition and social skills, four parents rated their children as increasing in these skills over the 10 sessions. In addition, on the Youth Top Problems questionnaire, which assesses parent identified behavioral change, six out of the eight parents rated at least two of the identified problems to have decreased over the course of the study.

Lastly, we assessed change in gaze to socially relevant cues following the intervention and hypothesized that there would be a significant change in the amount of fixation duration to facial region of the stimuli. The results suggest that for the participants for whom eye tracking data was available, change in gaze was not significant from pre to post intervention or during the treatment session. The manipulation did not successfully alter the gaze, indicating that the change in FER reported by the parents for most of the participants cannot be attributed to changes in viewing patterns (i.e., greater looking at the faces). However, due to loss of data limiting the analyses to half the sample, fixation patterns needs to be explored in future studies

Practical findings and Implications

This study was the first attempt to develop and implement a brief attention retraining paradigm to attenuate facial emotion recognition deficits in children with ASD. The results of the pilot study indicate the program is feasible to implement as planned and acceptable to the children and their parents. We endeavored to examine preliminary impact of the intervention on facial emotion recognition and social skills, with results suggesting that the paradigm is successful at increasing FER based on parent and child report and decreasing parent identified socioemotional problem behaviors. However, FER ability increase was only seen for behavioral tasks when FER scores were below average prior to the intervention. In addition, assessment of change in gaze revealed no significant change to socially-relevant cues following the intervention, therefore limiting support for the hypothesized mechanism behind the intervention in increasing gaze to socially relevant stimuli.

While the findings of this pilot study indicate feasibility and acceptability of this intervention, the impact on both FER and clinical outcomes is less clear. Future studies should employ larger samples with a control condition, in order to assess the potential impact of this intervention. Additionally, given variability in FER deficiency among children with ASD, it is important to ensure FER impairment among treatment recipients. Lastly, in future studies, it will be important to look at whether the proposed manipulation of highlighting the facial area increases processing of facial emotions or more general perception of social scenes (i.e., more attention to details in general) in order to better understand the mechanism behind the behavioral difficulties.

References

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