



Probing the Neurobiology of Attachment Processes: Oxytocin Facilitates Social Cognition in Autism

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BACKGROUND

OXYTOCIN
Nine-amino-acid peptide that acts as a neuromodulator in the brain;
Studies with animals show that oxytocin and the closely related peptide vasopressin are critically involved in affiliative behaviors, including sexual behavior, mother-infant and male-female pair-bond formation, separation distress, and other aspects of social attachment.

OXYTOCIN AND SOCIAL COGNITION
Research with rodents suggests that oxytocin (OT) may in part facilitate affiliation through its role in social recognition:
- Central OT admin. facilitates social memory in rodents (Popik et al 1992);
- OT receptor antagonist inhibits social recognition in female rats (Engelmann et al, 1998);
- OT "knockout" mice fail to recognize a conspecific over 2+ encounters (Ferguson et al, 2000);
- Social recognition in OT knockout mice can be rescued by bilateral microinjections of OT into medial amygdala prior to initial encounter (Ferguson et al, 2001).

This study sought to investigate whether oxytocin is involved in aspects of human social cognition. Autism presents a unique opportunity to examine the functional link between oxytocin and social cognition because deficits in social functioning and social cognition are core features of this disorder.

AUTISM
Individuals with autism spectrum disorders (ASD) show deficits in:
- Non-verbal behaviors (e.g., eye-contact, social smiling);
- Developing appropriate peer relationships;
- Sharing enjoyment;
- Social and emotional reciprocity, and empathy;
Moreover, parent reports indicate that individuals with autism prefer to stay isolated, miss social cues, and do not seem to recognize others.

Specific deficits in social cognition have been observed:
- Face recognition (Szatmari et al, 1990; Davies et al, 1994; Barton, 2003);
- Recognition of facial expressions (Hobson, 1987; Tantam et al, 1989);
and affective speech comprehension (Hobson et al 1989; Rutherford et al, 2002);

METHODS

PARTICIPANTS
- 15 adults (1 female) with high-functioning autism (n=6) or Asperger's syndrome (n=9);
- Mean age = 32.9 (range: 19-56) years;
- Diagnosis confirmed by Autism Diagnostic Interview (Lord et al, 1994).

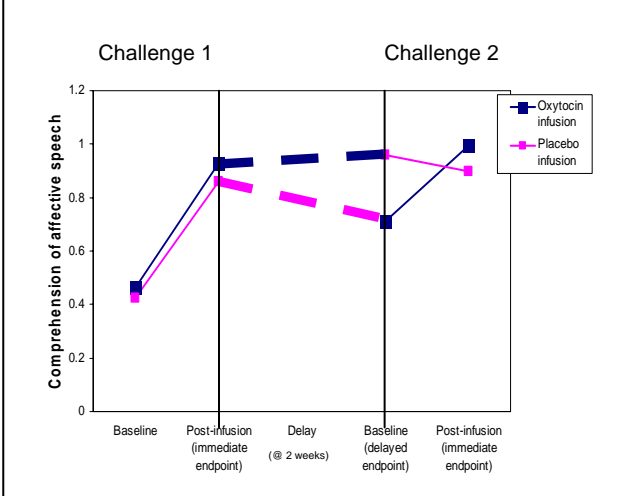
PROCEDURE
- Each participant served as his/her own experimental control;
- Participants randomized in a double-blind fashion to receive oxytocin and placebo challenges on separate days (delay: M=16; SD=14);
- Infusion order counterbalanced;
- Challenge began at 9:00 am following overnight fast;
- Oxytocin/placebo infused continuously over a 4-hr period;
- Pitocin (10 u/ml) combined with 1 L normal saline;
- Initial infusion rate was 10 ml/hr to minimize potential side effects, and was gradually titrated up to 700 ml/hr during the 4th hour.

COMPREHENSION OF AFFECTIVE SPEECH
- Participants presented with 4 pre-recorded sentences of neutral semantic content (e.g., "the boy went to the store");
- Each sentence presented twice in one of four emotional intonations (*happy, sad, angry, indifferent*);
- Pairing of sentences and emotional expression in 1 of 6 counterbalanced orders;
- Tested at baseline and at 30, 60, 90, 180, 240 min. throughout infusion;
- Dichotomously scored as 1 (*all items correct*) and 0 (*not all items correct*) because of negative skew.

RESULTS

- Mixed regression analysis used to model change in speech comprehension scores over time;
- Significant Time x Treatment x Order interaction for the dichotomized comprehension of affective speech score ($z = -2.134, p = 0.033, estimate = -0.170$) (Figure 1);
- Difference between predicted pretest scores for participants receiving placebo 2nd (0.958) and placebo 1st (0.712) was 0.246, corresponding to a medium to large effect size (d) of 0.66;
- Controlling for delay between infusions did not alter results.

Figure 1



DISCUSSION

Affective speech comprehension improved for all participants from pre- to post-infusion; however, those who received placebo 1st tended to revert to baseline after the delay, whereas those who received oxytocin 1st retained the ability to accurately assign emotional significance to speech intonation.

These findings are consistent with studies linking oxytocin to social recognition/social memory in rodents and suggest that oxytocin may play a role in human social information processing.

This research sheds light on neurobiology involved in human social-emotional information processing; future research should investigate whether oxytocin is involved in such other human social/affiliative behaviors as partner preference formation, empathy, and/or helping behavior.

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