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Social motivation in individuals with isolated cleft lip and palate

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Abstract

Social isolation is common among individuals with isolated cleft lip and palate (ICLP), but the available data on why this may be are mixed. We present a novel theory relating to reduced social motivation in ICLP, called the social abulia hypothesis. Based on this hypothesis, we predicted that reduced social motivation would lead to reduced responsiveness to negative social feedback, both in terms of explicit responses and non-controlled, psychophysiological responses.

Twenty males with ICLP and 20 normal comparison males (NC group) between 13 and 25 years old participated in the study. Social motivation was examined by measuring participants' response to negative social feedback (social exclusion). Additionally, psychophysiological reactivity to positive and negative social stimuli was measured. In order to rule out other potential contributors to social isolation, we tested basic social perception, emotion recognition, and social anxiety.

In line with the social abulia hypothesis, we show that negative social feedback had less of an effect on males with ICLP relative to healthy male peers, which was evident in explicit responses, and non-controlled, psychophysiological responses to negative social feedback. Our results could not be attributed to problems in social perception, a lack of understanding facial expressions, or increased social anxiety, as groups did not differ on these constructs.

This study suggests that current views on social isolation in ICLP may need to be reconsidered to include the possibility that isolation in this population may be the direct result of reduced social motivation.

Introduction

Isolated clefts of the lip and/or the palate (ICLP) are one of the most common congenital disorders, affecting 10 per 10,000 babies (Canfield et al., 2006). The term 'isolated' is somewhat misleading, because a host of cognitive - and behavioral problems usually accompany ICLP (Hunt, Burden, Hepper, & Johnston, 2005). Social dysfunction is particularly common, disproportionately affecting males (Hunt et al., 2005; Peter & Chinsky, 1974). Children with ICLP are shy and have fewer friends than their peers (Boes et al., 2007; Hunt et al., 2005; Hunt, Burden, Hepper, Stevenson, & Johnston, 2006). Fewer adults with ICLP are married or live with a partner than unaffected siblings or unrelated

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individuals without clefts (Peter & Chinsky, 1974), reflecting difficulties in establishing intimate relationships.

A common explanation for social isolation in ICLP is that a facial malformation affects success in social relationships, and under the assumption that social interactions are mostly negative, many studies have focused on self-esteem and social anxiety (Hunt et al., 2005, 2006; Kapp-Simon, McGuire, Long, & Simon, 2005; Kapp-Simon, 1986). However, the data on psychosocial problems in this population are mixed (Slifer et al., 2004). For instance, a thorough review of the literature on psychosocial functioning in ICLP concluded that self-esteem is high among individuals with ICLP (Hunt et al., 2005). There is some evidence of increased social anxiety in ICLP (Berk, Cooper, Liu, & Marazita, 2001; Demir, Karacetin, Baghaki, & Aydin, 2011; Murray et al., 2010)(Murray et al., 2010); although the results are inconsistent (Cochrane & Slade, 1999; Hunt et al., 2006).

The biological aspects of social behavior are largely overlooked in the literature (Nopoulos, Richman, Murray, & Canady, 2002). Social behavior is a highly heritable trait (Nopoulos, Richman, et al., 2002), and research in various species have confirmed the biological basis of social behavior (Robinson, Fernald, & Clayton, 2008). The idea that social isolation in ICLP may be the direct result of abnormal biology should be given more attention, particularly in view of the close pre-natal developmental relationship between the face and the brain (Nopoulos, Berg, et al., 2002). Indeed, a Magnetic Resonance Imaging (MRI) study of live human fetuses demonstrated that brain abnormalities in ICLP are evident *in utero* (Kasprian et al., 2011). Brain abnormalities, in particular affecting the frontal lobes and the cerebellum, have also been demonstrated in children and adults with ICLP (Nopoulos, Langbehn, Canady, Magnotta, & Richman, 2007; Nopoulos, Berg, et al., 2002; van der Plas, Conrad, Canady, Richman, & Nopoulos, 2010). Moreover, social behavior was found to be directly related to abnormalities in the medial orbitofrontal cortex (mOFC) (Boes et al., 2007; Nopoulos et al., 2005), which is a critical region in governing social behavior in humans (Amodio & Frith, 2006). Therefore, instead of conceptualizing social isolation in ICLP as a psychological reaction to living with a facial deformity, it could be that social isolation in ICLP is a manifestation of aberrant brain development affecting the regions of the brain that govern social behavior.

The mOFC is integral for reward and punishment processing as well as processing the significance or value of the stimuli that surround us (Elliott, Agnew, & Deakin, 2010; Kringelbach, 2005). When damaged, patients have difficulties processing rewards and punishments (Bechara & Damasio, 2002; Eslinger & Damasio, 1985), which is also evident at the autonomic level through diminished skin conductance responses (SCR) to meaningful social stimuli (Bechara, 1997; Damasio, Tranel, & Damasio, 1990). Adding an evaluative 'tag' to stimuli provides information on what stimuli can be approached and what should be avoided (Adolphs, 1999; Damasio et al., 1990; Damasio, 1994). Without such tags, stimuli become affectively indistinguishable. Social behavior is highly motivated behavior (Reykowski, 1982) and owing to the loss of appreciation of the intrinsic rewarding properties of social interactions, patients with mOFC damage have a reduced desire to spend time with others (Damasio & Anderson, 2003; Eslinger & Damasio, 1985). In this scenario, social isolation is the result of reduced motivation to seek out social contacts.

Within this framework we generated an alternative hypothesis about social isolation in ICLP. Given the role of the frontal lobes in social motivation in conjunction with the evidence for structural abnormalities in this region in ICLP, we predicted that social isolation in ICLP is due to reduced social motivation. The lack of motivation is referred to as abulia or 'non-will' (Marin & Wilkosz, 2005), and we refer to this theory as the social abulia hypothesis. We predict that social isolation in individuals with ICLP is caused by reduced

motivation to engage in social activity due to diminished impact of social rewards and punishments normally associated with these types of interactions (Hawkley, Williams, & Cacioppo, 2011; Reykowski, 1982; Williams, 2007a, 2007b; Zadro, Williams, & Richardson, 2004). Therefore, social situations that usually elicit strong responses, such as negative social feedback, are predicted to produce a weaker response in individuals with ICLP, which is evident in explicit responses, as well as non-controlled physiological responses (i.e., SCR) to these types of situations. To rule out potential confounding factors, we evaluated basic social perception skills and social anxiety.

Methods

The study was approved by the University of Iowa Institutional Review Board. Informed consent was obtained from all participants. If a participant was younger than 18 years old, consent was also obtained from one parent or legal guardian.

Participants

We aimed to optimize homogeneity and increase our power by limiting our sample to males. Additionally, all males with ICLP were born with clefts that affected both the lip and the palate, either unilaterally (UCLP) or bilaterally (BCLP).

The ICLP group consisted of 20 males (age range: 13 – 25 years, mean age = 19.81, $sd = 3.31$). Twelve participants had left UCLP, 3 had right UCLP and 5 had BCLP. Participants with ICLP were drawn from a large longitudinal study on brain development in ICLP. Participants were excluded if (1) the cleft was due to a known syndrome, (2) if they had a history of severe hearing loss requiring a hearing aid, (3) significant cognitive impairment ($IQ < 70$), or (4) had a history of epilepsy, brain tumor, or brain trauma. The diagnosis of ICLP was only made when there were no other findings that were suggestive of a syndrome.

The normal comparison (NC) group consisted of 20 males as well (age range: 14 – 25 years old, mean age = 19.55, $sd = 3.11$). The two groups did not significantly differ in terms of age ($t = -.288, p = .775$). The NC participants were also drawn from those who consented to participate in the longitudinal study.

NC participants were excluded if (1) they had a history of learning disability, (2) were identified as gifted, skipped a grade or participated in a talented program, (3) had a psychiatric or medical diagnosis requiring medication or counseling, (4) had a history of heart surgery, brain tumors, brain trauma, or epilepsy, (5) severe hearing loss requiring a hearing aid.

Academic performance

Educational performance scores were collected to assess participants' performance in school. The scores are based on parents' rating of performance in school on a 7-point Likert scale.

Behavioral assessment

Social adjustment—The Self-Description Questionnaire (SDQ) was used to evaluate self-reported general social adjustment (Marsh, 1992). The SDQ-II is for individuals between 13 – 17 years old, and contains 102 questions, while the SDQ-III is for individuals age 18 and up and contains 136 items. The extra items on the SDQ-III were not included in the analyses. Without the extra items, the two versions have the same subscales and scores on these scales are converted to compatible T-scores. The social subscales of the SDQ contain questions about friends and romantic relationships. Examples of the items include:

“I do not get along with boys”, or “I am popular with girls”. Responses are rated on a 6-point Likert scale.

Social anxiety—Social anxiety was measured with the Fear of Negative Evaluation scale (FNE), which consists of 30 true- false items about the cognitive aspects of social anxiety, in particular social evaluation (Watson & Friend, 1969). The internal consistency for this scale ranges from .92 to .94 (Berk et al., 2001) and the FNE is highly reliable (Weeks et al., 2005).

Social perception – eye-tracking—The ability to effectively ‘read’ emotional faces and derive socially relevant information is essential for social perception (Pelphrey et al., 2002; Riby & Hancock, 2008). Using eye-tracking, previous research has demonstrated that most individuals tend to look at the eyes for socially relevant information (Klin, Jones, Schultz, Volkmar, & Cohen, 2002a, 2002b; Pelphrey et al., 2002). To assess whether individuals with ICLP show the same preference, eye movements were measured with an eye tracker (Eye-link 100) that did not require either special goggles or chin-rest to immobilize the participant. Participants looked passively at 108 human faces expressing various emotions (Ebner, Riediger, & Lindenberger, 2010), including neutral, happy, angry, sad, fear, and disgust. A fixation cross was visible at the center of the screen for 500 milliseconds at the beginning of each trial. Then, a face appeared for 5 seconds, followed by an inter-stimulus interval (blank screen) of 2 seconds. Eye-tracking data were collected at the same time as the SCR data.

Regions of interest were identified for each of the 108 stimuli, including the eyes, nose, philtrum, mouth, chin, cheeks, forehead, and outside of facial area. The main outcome measure was fixation duration within these regions averaged across all stimuli.

Emotion recognition—After passively viewing 108 faces, participants were given a response box with 6 response buttons for neutral, happy, angry, sad, fear, and disgust respectively. They then viewed an additional 24 faces from the same database (Ebner et al., 2010) for 2 seconds each, and were asked to indicate which emotion was expressed by pressing one of the buttons.

Physiological reactivity to faces—While participants were viewing faces as part of the social perception task, SCR was measured via electrodes from the participant’s non-dominant hand.

SCR data were collected at 1000 Hz, using a Biopac MP150 and Acknowledge 4.0 software. Two electrodes were placed on the participant’s non-dominant palm, on the thenar and hypothenar eminences. SCR analyses were performed using the LedaLab toolbox version 3.0 for Matlab (r2007b). First, SCR data were down-sampled by a factor of 10 to speed the analysis. Second, data were smoothed using an adaptive Gaussian filter, to remove high-frequency artifacts that are due to noise. Third, a continuous decomposition analysis was performed (Benedek & Kaernbach, 2010). This analysis decomposes SCR data into continuous tonic and phasic activity, and it is comparatively fast and quite robust to artifacts. Three sets of initial values were used to optimize the solution. Fourth, to examine event-related activation, two time windows were examined: 1. A pre-stimulus window containing the 3 seconds immediately prior to stimulus onset, and 2. a post-stimulus window 1 to 4 seconds following stimulus onset. We used 0.01 μS as a minimum threshold for significant SCR activity. Finally, two variables of interest were extracted: 1. Number of significant (above threshold) SCRs within the response window, and 2. area under the phasic driver curve (i.e., time integral), in $\mu\text{S} \cdot \text{s}$. Continuous decomposition analyses were performed on the SCR data. This extracts the phasic activity from tonic activity, removing any drift over

time and leaving just the peaks. The area under the curve was used for analyses. The SCR obtained for each of the 108 faces were then averaged across each of the 6 facial expressions to reflect the mean response to a particular emotional for each participant. Average SCR for each emotion was used as the main outcome measure was used for the group analyses.

Social motivation—Social behavior is highly motivated behavior, which is why negative social feedback such as social exclusion elicits a strong emotional response (Hawkley et al., 2011; Reykowski, 1982). To assess participants' responses to social feedback, half of the participants of each group were briefly excluded in a ball-tossing game called Cyberball, while the other half played the game normally (Williams & Jarvis, 2006). Cyberball was always administered as the last task to avoid 'emotional contamination' of our other results. Responses to Cyberball were recorded with a questionnaire designed for Cyberball called the Adverse Impact Scale (AIS). The ball game appeared as though it were online and multiplayer, although all other players were simulated. The participant picked an avatar to represent him, and entered his name before the ball game. When the participant pressed the start button, a pop-up window came up telling the participant that the program was waiting for other players. After a few seconds it would tell the participants that Adam and Jackson were connected. The next screen would show the avatars and the names of all the players. The avatars of the simulated players were accompanied with a drawing of a little person while the participant's avatar was accompanied by a drawing of a hand. The participant could throw the ball to the other players by clicking on their avatar. Participants automatically caught the ball when it was directed to them.

Participants were randomly assigned to different conditions: half of the participants were assigned to the social inclusion condition, while the other half was assigned to the social exclusion condition. Socially-included participants received the ball as often as the other two players, whereas socially-excluded participants only received the ball from the other players twice within the first 4 tosses, after which they never received the ball again. The two other players continued to toss the ball to each other and the game ended after 30 tosses.

After playing the game, participants' responses were measured with the AIS. The AIS has two basic components. First, whether participants felt as though their basic social needs were threatened using 9-point Likert scales. This yields four composite basic social needs scores, including: belonging, control, self-esteem, and meaningful existence. The second component of the AIS assessed participants' emotional response via dichotomous mood items. The idea is that when basic social needs were threatened, participants would experience more negative emotions (Zadro et al., 2004). To measure emotional responses after Cyberball, the question '*During Cyberball I felt...*' was followed by four dichotomous items which included: good or bad, happy or sad, tense or relaxed, and aroused or not aroused. The questionnaire also included two yes/no questions, i.e., '*During Cyberball I felt angry*', '*I enjoyed playing Cyberball*'. The AIS also includes a manipulation check, which asks participants to estimate the percentage of time that they received the ball from the other players. After completing the AIS, participants were asked whether they believed they played against real others (response options yes, no, maybe). They were then debriefed about the purpose of the game.

Results

Academic performance

Academic performance scores were available for 15 NC participants and 18 ICLP participants, as not all parents returned all the materials or provided a response on this item. The average scores were 2.07 (SD = .80) for NC and 2.86 (SD = 1.47) for ICLP, where a higher score represents poorer performance. In order to compare educational performance,

an independent samples t-test was conducted. This test was found to be statistically non-significant $t = -1.97$, $p = .06$, two-tailed (effect size $r^2 = .13$), equal variances not assumed. When added as a covariate, academic performance was not significantly associated with social adjustment ($p = .26$), social perception ($p = .25$), emotion recognition ($p = .95$), autonomic reactivity ($p = .61$) or social motivation ($p = .41$). When added as a covariate to the social anxiety analyses, academic performance did reach significance, $F(1, 30) = 5.78$, $MSE = 199.84$, $p = .03$ (eta squared $\eta^2 = .15$), although it did not change the main effect of group $F(1, 30) = .01$, $MSE = 199.84$, $p = .91$. Further exploration revealed a statistically significant relationship between academic performance and social anxiety, $r(33) = -.40$, $p = .02$, which was mainly driven by the NC group. This correlation indicated that better performance in school was related to more social anxiety.

Social adjustment

A single composite score for social functioning was created by adding the scores for the same-sex relations and opposite-sex relations subscales. To compare social scores, an independent samples T-test was conducted, which yielded a statistically significant group effect for social functioning $t(38) = 2.226$, $p = .032$, effect size $r^2 = .12$. These results indicate that participants with ICLP ($M = 94.70$, $SD = 21.13$) were socially isolated relative to healthy peers ($M = 107.05$, $SD = 13.01$) (See Figure 1).

Social anxiety

Participants' responses were converted such that a higher sum score indicated higher social anxiety. Sum scores for each group were compared with an independent samples T-test. This test was found not to be statistically significant, $t(38) = .65$, $p = .520$, effect size $r^2 = .011$. Both groups had low mean scores on the FNE (NC $M = -2.10$, $SD = 14.08$; ICLP $M = -5.20$, $SD = 16.03$). This suggests that neither males in the control group nor males with ICLP in the current sample suffered from social anxiety.

Social perception

One NC participant was not included in these analyses due to technical difficulties during the social perception task.

To examine potential differences in facial perception, total fixation duration within 8 facial regions (eyes, nose, philtrum, mouth, chin, cheeks, forehead, outside of facial area) averaged across facial stimuli was submitted to a repeated measures ANOVA with group as the independent variable. This resulted in a highly significant effect for facial area ($F(2.35, 89.31) = 127.57$, $MSE = 1.02 * 10^9$, $p < .0001$, $\eta^2 = .77$). Participants preferentially looked at the eyes, followed by the nose and the mouth, while they spent less time looking at the other regions in the face (See Figure 2). There was no effect of group $F(1, 38) = 1.74$, $MSE = 1.78 * 10^8$, $\eta^2 = .04$, and no interaction $F(7, 27) = .36$, $MSE = 1.02 * 10^9$, $\eta^2 = .01$.

Emotion recognition

Mean scores for emotion recognition were compared with an independent samples T-test. This did not reveal any group differences $t(38) = .10$, $p = .91$, effect size $r^2 = .0002$. The scores (proportion correct) for both the ICLP group ($M = .93$, $SD = .07$) and the NC group ($M = .93$, $SD = .07$) were high and nearly identical, suggesting that there were no differences between groups in terms of understanding emotional signals.

Autonomic reactivity to emotional faces

One NC participant was not included in these analyses due to technical difficulties during the social perception task.

Mean SCR to neutral expressions, positive expressions (i.e., happy) and negative expressions (i.e., average of sad, angry, fear and disgust) were entered as dependent variables in a 3 (Emotion; neutral, positive, negative) x 2 (NC vs. ICLP) repeated measures ANOVA.

The social abulia hypothesis predicts a diminished response to social stimuli, and the following analyses evaluated whether this is evident in SCR reactivity to faces expressing various emotions. The results revealed a significant group by emotion interaction ($F(2, 74) = 3.60$, $MSE = .01$, $p = .03$, $\eta^2 = .08$), showing that the NC group's SCR to negative expressions was significantly higher relative to the mean SCR for the ICLP group in response to the same expressions (See Figure 3).

Social motivation

The negatively worded items on the AIS were converted, such that a higher score on the four Likert scales (belonging, control, self-esteem, and meaningful existence) indicated a more positive attitude. We ran a multivariate ANOVA with AIS scores as the dependent variables and Cyberball condition (i.e., being included or excluded) and group as the independent variables, resulting in an 11 (dependent variables) x 2 (Condition; included, excluded) x 2 (NC vs. ICLP) multivariate ANOVA. The following 11 variables were entered as the dependent variables: average score for each of the four Likert scales, the four mood items (good/bad, happy/sad, tense/relaxed, aroused/not aroused), the two yes/no items (I felt angry, I enjoyed Cyberball), and the estimated percentage when the ball was received during the game. Given our hypothesis, we predicted to find a significant condition x group interaction, i.e., social feedback has a differential effect depending on cleft status.

Descriptive analyses—10 NC participants and 9 ICLP participants were randomly assigned to the social-inclusion condition while 10 NC participants and 11 ICLP participants were randomly assigned to the social-exclusion condition. Socially-excluded participants with ICLP did not differ in age compared to socially excluded NC participants, $F(1, 19) = .55$, $MSE = 12.97$, neither did these groups differ on years of education, $F(1, 19) = .01$, $MSE = 8.87$. Similarly, socially-included participants with ICLP did not differ in age compared to socially-included NC, $F(1, 17) = 1.97$, $MSE = 8.73$, although the socially-included NC group had more years of education relative to the included ICLP group, $F(1, 17) = 6.45$, $MSE = 4.51$, $p = .02$.

On average, 57.5% of participants did not believe Cyberball was a real online game, 15% did believe the game was real, 25% responded 'maybe', indicating that they believed the game at first, but then started to doubt that assumption, and for 1 participant with ICLP no believability data were collected. A Fisher's Exact Test demonstrated that groups did not differ in whether or not they believed that Cyberball was a real game, $p = .40$. There was no significant difference in the response to Cyberball, between individuals who believed the game was real and those who did not believe the game was real, $F(30, 78) = .84$, $p = .70$, and there was no significant condition by belief interaction, $F(20, 50) = .67$, $p = .84$. These descriptive analyses suggest that the results were not affected by differences in demographics between excluded and included groups, or by differences in belief.

The main effect of condition was significant, $F(10, 27) = 17.67$, $p < .0001$. Closer inspection of the results showed that social exclusion affected participants' responses for the 4 basic needs items, as socially-excluded participants reported lower ratings for belonging, control, self-esteem, and meaningful existence (see Table 1). There were no significant condition x group interactions for these items, suggesting that these effects were entirely driven by condition (main effect) while group status did not affect participants' ratings on these items. The effect of condition was also significant for most of the emotional items (See

Table 1), except for the tense item ($p = .36$). Socially-excluded participants also reported they had received the ball less often than the included group ($p < .0001$, See Table 1).

There were three significant group $\times$ condition interaction effects for emotional items, including: I enjoyed Cyberball, I felt good during Cyberball, and I felt happy during Cyberball (See Table 1; See Figure 4). Follow-up one-way ANOVAS were then performed on these items for each condition separately to establish what was driving the significant interaction terms. These post-hoc analyses showed that condition had a significant effect on NC participants' ratings on the aforementioned items: Relative to included NC participants, socially-excluded NC participants reported that they enjoyed the game less ($p < .0001$), did not feel as good ($p < .0001$) and were not as happy ($p < .0001$). However, condition had a much weaker effect on ICLP participants' responses: There was no significant difference in enjoyment between socially-excluded and -included ICLP participants ($p = .42$), neither did condition have a strong effect on feeling good ($p = .10$) or feeling happy ($p = .10$) in this group.

Thus, cleft status did not have an effect on the responses on the basic social need items, but consistent with our hypothesis, social feedback did not have as strong of an effect on ICLP participants' emotional responses relative to NC participants.

Discussion

Negative social feedback elicited differential explicit and physiological responses in males with ICLP, providing some evidence for the social abulia hypothesis of reduced social motivation. Social inhibition in this sample of individuals with ICLP could not be due to a general lack of social skills, a lack of understanding of social signals, or a tendency to avoid others out of fear of negative evaluations. First, scanning patterns were remarkably similar among groups, ruling out the possibility of potential deficits in social skill (Berk et al., 2001; Krueckeberg, Kapp-Simon, & Ribordy, 1993). Second, the groups were equally good at recognizing facial expressions. Similarly, social anxiety scores were low, and did not differ between the groups.

Social motivation is evident in strong, negative reactions to social exclusion (Hawkey et al., 2011; Williams & Jarvis, 2006; Williams, 2007a; Zadro et al., 2004). Socially-excluded participants in the current study reported greater threat of their basic social needs, including: lower sense of belonging, feelings of loss of control, lower self-esteem, and reduced sense of meaningful existence. Under normal circumstances, one would predict that this elicits a negative emotional response (Zadro et al., 2004), which was indeed the case for the NC participants who were socially excluded. However, males with ICLP had a more positive attitude after the game relative to the NC males. Given that the groups did not differ in terms of basic social needs suggests that both groups were aware that the other players excluded them from the game and that their social standing was threatened. It is therefore unlikely that the ICLP group experienced the game differently and believed that they were included when they were not. The group differed in the emotional response to social exclusion, suggesting responses to social feedback are abnormal in individuals with ICLP. The SCR analyses support this notion, as SCR was weaker in response to negative social feedback (i.e., negative facial expressions) for ICLP participants than NC participants. In addition to between-group comparisons, it would also have been informative to measure participants' mood before- and after Cyberball to infer the direct impact of social exclusion within participants. Based on the social abulia hypothesis, we would predict a weaker change in mood in individuals with ICLP compared to unaffected peers. This should be tested in future studies on feedback processing in ICLP.

As discussed earlier, the mOFC plays an essential role in processing the significance of the stimuli in our environment by adding an evaluative tag to stimuli (Adolphs, 1999; Damasio et al., 1990; Damasio, 1994). Social interactions are generally perceived as rewarding, which drives people to seek out others as opposed to being isolated (Hawkley et al., 2011; Reykowski, 1982). Under normal circumstances, this drive is so intense that people respond strongly to negative social feedback (Hawkley et al., 2011), captured in the NC group's negative emotional response to social exclusion and the increased SCR to negative facial expression. Intriguingly, both self-reported responses and physiological reactivity to negative social feedback were different in ICLP relative to unaffected peers. Another study also found that negative feedback, in this case not receiving a toy that was previously promised, triggered a weaker negative response in preschoolers with ICLP than peers (Endriga, Jordan, & Speltz, 2003). It may be that the mOFC in ICLP does not respond appropriately to relevant stimuli in the environment, resulting in a weaker response to stimuli that normally trigger a strong response, such as social stimuli. Reduced social motivation may also provide an alternative explanation for findings from observational studies that show that individuals with ICLP were less likely to actively participate in conversations relative to healthy peers, while more likely to be at the periphery of the group (Kapp-Simon & McGuire, 1997). Another study reported that children with ICLP often failed to respond to peer questions (Slifer et al., 2004). In other words, if social stimuli have a weaker impact on individuals with ICLP, they may be less compelled to become actively involved in social interaction.

Alternatively, one could argue that the altered response in individuals with ICLP is the result of repeated exposure to social exclusion, leading to desensitization to negative social experiences. We cannot rule out this possibility, however previous research suggests that, at the least, differences between individuals with and without ICLP in terms of responses to feedback (Endriga et al., 2003) are present even before the developmental transition from solitary play to social play (Dhingra, Manhas, & Raina, 2005). Thus, children with ICLP seem to respond differently to feedback before they start to engage in social play and hence may experience social exclusion. Nevertheless, future research could explore, through naturalistic observation, whether young children with ICLP are already at risk for being excluded by peers, despite efforts to be included in the social group. The current literature on social isolation in ICLP has favored the view that peers exclude individuals with ICLP because of their appearance. Although this is certainly possible, it is important to consider the role that all social partners play in social interactions, including the possibility that individuals with ICLP may respond differently to social feedback. Interestingly, there is some evidence that the rate of social interaction between adolescents with craniofacial conditions (CFC) and unaffected peers increase after individuals with CFC have received social skill training (Kapp-Simon et al., 2005). This is encouraging, since it suggests that training interventions may alleviate social problems in ICLP. Expanding our understanding of social behavior in this population is therefore important, as it may help in generating effective interventions.

Another issue that should be considered in this context is the relationship between poor academic performance and lower social competence (Kavale & Forness, 1996). Individuals with ICLP tend to perform more poorly in school relative to peers (Richman & Eliason, 1982), which was to some extent reflected in the current sample. There was a trend driven by the NC group, suggesting that high academic performance was related to increased social anxiety. However, given that there was no significant relationship between academic performance and social anxiety within the ICLP group, nor any other social measure included in our study, it appears that other factors are of greater importance in determining academic outcomes in individuals with ICLP. Further research is needed to examine the

possibility of a link between academic performance and social competence, especially if we are to expect that social interventions may improve academic performance.

In conclusion, this study demonstrated that reduced social motivation, or social abulia, may play a role in social inhibition in males with ICLP, as they responded differently to negative social feedback than peers. This was evident in both explicit, self-reported responses as well as in non-controlled, psychophysiological responses. More research is needed to make firm conclusions about social adjustment problems and the role of social motivation in this population, including females. Social abnormalities are likely the result of an interplay of factors, and adopting an integrated model, including the potential role of abnormal brain development, may bring the field closer to potential solutions.

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Figure 1.
Social adjustment - Individuals with ICLP (light gray) are more socially isolated relative to healthy peers (dark gray)

Figure 2.
Social perception – Participants, regardless of cleft status, looked longer at the eyes, nose and mouth of stimulus.

Figure 3.

Autonomic reactivity to emotional faces – Individuals with ICLP (light gray) had weaker SCR in response to faces expressing negative emotions relative to NC participants (dark gray)

Figure 4. Significant interaction effects on AIS ratings. Cyberball condition had a significant effect on NC participants' (dark gray) ratings, but not on ratings of ICLP participants (light gray).

Table 1

Statistics for AIS variables

	Included			Excluded		Main effect Condition p value, ω^2	Condition x Group p value, ω^2
	NC (n=10)	ICLP (n=9)	NC (n=10)	ICLP (n=11)	Mean (SD)		
Fundamental needs	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			
Belonging	20.6 (4.5)	19.4 (2.1)	6.9 (4.6)	9.1 (5.8)	$p < .0001$, $\omega^2 = .14$	$p = .253$, $\omega^2 = .0007$	
Control	21.6 (3.4)	20.8 (3.2)	9.0 (3.2)	10.2 (5.1)	$p < .0001$, $\omega^2 = .12$	$p = .420$, $\omega^2 = .0005$	
Self-esteem	16.6 (1.5)	16.0 (2.1)	13.0 (4.1)	15.3 (2.5)	$p = .02$, $\omega^2 = .004$	$p = .107$, $\omega^2 = .001$	
Meaningful existence	18.8 (5.5)	19.1 (3.8)	9.7 (4.1)	10.4 (6.0)	$p < .0001$, $\omega^2 = .08$	$p = .912$, $\omega^2 = -.003$	
Emotional response							
I felt angry during Cyberball	-1.0 (0.0)	-1.0 (0.0)	-0.4 (1.0)	-0.6 (0.8)	$p = .024$, $\omega^2 = .05$	$p = .566$, $\omega^2 = -.007$	
I enjoyed Cyberball	0.8 (0.6)	0.1 (1.1)	-0.8 (0.6)	-0.3 (1.0)	$p = .001$, $\omega^2 = .22$	$p = .031$, $\omega^2 = .07$	
I felt good during Cyberball	1.0 (0.0)	1.0 (0.0)	-0.6 (0.8)	0.5 (0.9)	$p < .000$, $\omega^2 = .27$	$p = .015$, $\omega^2 = .06$	
I felt happy during Cyberball	1.0 (0.0)	1.0 (0.0)	-0.6 (0.8)	0.5 (0.9)	$p < .000$, $\omega^2 = .27$	$p = .015$, $\omega^2 = .06$	
I felt tense during Cyberball	-1.0 (0.0)	-0.8 (0.7)	-0.6 (0.8)	-0.8 (0.6)	$p = .362$, $\omega^2 = -.001$	$p = .266$, $\omega^2 = .003$	
I felt aroused during Cyberball	0.4 (1.0)	0.3 (1.0)	-0.4 (1.0)	-0.5 (0.9)	$p = .014$, $\omega^2 = .13$	$p = .984$, $\omega^2 = -.02$	
Manipulation check							
Estimated % of ball received	46.8% (12.4)	49.0% (21.3)	5.6% (2.9)	4.3% (2.8)	$p < .0001^a$, $\omega^2 = .37$	$p = .644$, $\omega^2 = -.002$	
Semipartial ω^2							