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Parent–Child Interactions During the Initial Weeks Following Brain Injury in Young Children

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Abstract

Objective—To understand how traumatic brain injury (TBI) affects parent–child interactions acutely following injury.

Participants—Young children hospitalized for TBI (n = 80) and orthopedic injuries (OI; n = 113).

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Method—Raters coded videotaped interactions during free play and structured tasks for parental warmth/responsiveness and negativity and child warmth, behavior regulation, and cooperation. Raters also counted parental directives, critical/restricting statements, and scaffolds.

Results—Parents of children with TBI exhibited less warm responsiveness and made more directive statements during a structured task than parents in the OI group. Children with TBI displayed less behavior regulation than children with OI. Parental warm responsiveness was more strongly related to child cooperativeness in the OI group than in the TBI group. Child behavior also mediated group differences in parental responsiveness and directiveness. TBI accounted for as much variance in parental behaviors as or more than did sociodemographic factors.

Conclusion—TBI-related changes in child behavior may negatively influence parent–child interactions and disrupt the reciprocity between parent and child.

Keywords

early childhood; traumatic brain injury; parent–child interaction; family impact

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Research has clearly documented the central role during early childhood that parenting behaviors play in a child’s social, emotional, and cognitive development (Bornstein & Tamis-LeMonda, 1989; Landry, Smith, Swank, Assel, & Vellet, 2001; Weizman & Snow, 2001). These findings suggest that warm and responsive parenting, together with verbal stimulation and cognitive support, contributes to optimal cognitive and behavioral development in typically developing children. However, less is known about how medical conditions that affect the health and functioning of the child, such as traumatic brain injury (TBI), influence the quality and nature of the parent–child relationship. Some studies suggest that parents of young children with health problems display more negativity (Pipp-Siegal & Biringen, 1998) and directiveness (Landry, Chapieski, Richardson, Palmer, & Hall, 1990) than parents of typically developing children in their interactions. However, research with other populations and somewhat older samples (e.g., preadolescents with spina bifida) found no differences in parent–child interactions as a function of the child’s diagnosis (Seefeldt et al., 1997). Findings differ as a function of the methodology (e.g., parent report vs. observation) and population of interest, making it difficult to draw inferences regarding how specific health conditions affect the parent–child relationship.

Research regarding children with mental retardation (MR) has provided some of the best and most extensive evidence regarding the potential effects of child cognitive status on parent–child interactions. This body of literature also underscores the potential complexity of these relationships. Findings suggest that parents of children with MR display greater levels of behavioral direction coupled with fewer positive behavioral exchanges than parents of typically developing children (Floyd, Harter, & Costigan, 2004; Floyd & Phillipe, 1993; Floyd & Zmich, 1991; Tannock, 1988). Although some studies have noted higher levels of negativity among parents of children with MR (Floyd & Zmich, 1991), others have found no differences (Floyd et al., 2004). Directiveness and commands may in fact serve positive functions in this population (Floyd & Costigan, 1997), enabling parents to engage children in activities (Tannock, 1988) and manage problem behaviors noncoercively (Floyd & Phillipe, 1993). However, other factors, such as socioeconomic status (SES; Floyd &

Saitzyk, 1992) and child behavior problems (Floyd et al., 2004), may serve as stronger determinants of parent–child interactions than the nature of the child's condition. Thus, it is important to understand the genesis and function of specific parenting behaviors in children with health conditions or disabilities.

Existing research suggests that changes in parenting behaviors and parent–child interactions may be brought about by parental distress resulting from the child's condition (Quittner, Opipari, Regoli, & Jacobsen, 1992), by parental perceptions of the child (Holmbeck et al., 2002; Stern, Karraker, Sopko, & Norman, 2000), or as a result of the child's behavior, specifically, his or her need for structure and cognitive support (Keogh, Garnier, Bernheimer, & Gallimore, 2000; Landry et al., 1990). The literature on bonding and attachment suggests that maternal depression disrupts the natural reciprocity between parent and child (Tronick & Weinberg, 1997). However, another body of research suggests that differences in the child's behavior and needs arising from his or her cognitive or medical status may alter the nature of parent–child interactions irrespective of the parent's level of distress (Floyd & Costigan, 1997). In fact, several studies have found parent–child interactions to be more related to child characteristics than parent characteristics. In a study of young children with developmental delays, Keogh et al. (2000) found that the frequency and intensity of accommodations to the child's disability were related to the characteristics of the child, such as the need for frequent monitoring, rather than SES or maternal education. Similarly, Landry et al.(1990) found that mothers of very-low-birth-weight toddlers were more likely to direct their children, whereas mothers of full-term children were more likely to use suggestions, even after controlling for child IQ and maternal education. Among preadolescents with spina bifida, parental overprotection was in part mediated by the child's cognitive status, suggesting that observed differences in parental behavior were partially determined by the child's behavior (Holmbeck et al., 2002). However, because children in these studies had been diagnosed several years previously, their findings do not shed light on the effect of abrupt changes in the child's condition due to acute illness or injury on parenting behaviors.

Parenting behaviors may also change as a result of beliefs about the diagnosis rather than changes in the child's behavior (Stern & Hildenbrandt, 1984). For example, experimental investigations regarding perceptions of premature infants demonstrated that awareness of a diagnosis (i.e., prematurity) caused individuals, including parents of babies born prematurely, to perceive and interact with the child in a less positive fashion (Stern et al., 2000). In these studies, the same child was labeled as either full term or premature, thereby enabling the investigators to separate the label or diagnosis from the child's characteristics. Although mothers of premature infants engaged in prematurity stereotyping with infants other than their own, they did so to a lesser extent than parents of full-term infants, suggesting that experience with the condition may reduce, but not eliminate, such stereotyping.

Parent–child interactions following childhood TBI have not been explicitly examined; however, anecdotal reports suggest that parents' behavior toward their child may change, marked by increasing overprotectiveness and less consistent disciplinary practices (DePompei & Zarski, 1989). Studies of other populations reviewed previously suggest that

TBI in young children has the potential to alter parent–child interactions through several distinct pathways. First, parental burden and distress arising from the injury may cause the parent to be less warm and responsive to his or her child (Tronick & Weinberg, 1997). Several previous studies have demonstrated that TBI in school-age children contributes to adverse caregiver and family outcomes for many years following the injury, including elevated psychological symptoms and distress (Rivara et al., 1992; Wade, Taylor, Drotar, Stancin, & Yeates, 1998; Zarski, DePompei, & Zook, 1988). Although study design limitations preclude the possibility of totally distinguishing preexisting issues from injury-related concerns, these findings suggest that TBI in children is associated with parent and family distress that could affect parental warmth and responsiveness. Second, changes in child behavior caused by TBI may contribute to changes in parent–child interactions (see Floyd et al., 2004). Pediatric TBI can result in deficits in cognitive skills, behavior, and social competence (Taylor et al., 2002), and existing data suggest that TBI in a young child results in potentially more severe sequelae than is the case for older children (Anderson, Catroppa, Rosenfeld, Haritou, & Morse, 2000; Anderson et al., 1997). Thus, parents of young children with TBI may alter their behavior toward their child following the injury to provide greater cognitive support (scaffolding) and direction. Increased parental stress coupled with child behavior difficulties resulting from TBI (such as impaired initiation and self-control) may lead caregivers to exhibit less warmth while providing greater direction and control than they did prior to the injury. Finally, negative perceptions regarding the diagnosis of TBI may exacerbate parental concerns and, concomitantly, their overprotection and control. As a consequence, the child may have less opportunity to function independently and to develop or relearn skills (Landry, Smith, Miller-Loncar, & Swank, 1997).

In this investigation, we sought to understand the effects of pediatric TBI on parent–child interactions by addressing the following objectives: (a) to examine differences in parent–child interactions following TBI relative to orthopedic injuries (OI) not involving the central nervous system (CNS), (b) to examine the contributions of parental depressive symptoms and child behavior to parental interactions after controlling for potential sociodemographic influences, and (c) to determine whether the relationship between parent and child behaviors varied as a function of the child's injury (TBI vs. OI). On the basis of previous research indicating that TBI adversely affects child behavior (Taylor et al., 2002), we hypothesized that children with TBI would be rated as less cooperative and less behaviorally regulated than children with OI, with the degree of dysregulation proportional to the severity of the injury. We also hypothesized that parents of children with TBI would be rated as less warm and responsive and more directive and critical than parents of children with OI. To better understand the relationship of TBI to changes in parental behavior (Objective b), we examined the contribution of parental distress, child behavior (e.g., behavior regulation), and injury severity to parent behavior after controlling for race and SES. We hypothesized that both parental distress and child behavior would mediate the relationship between TBI and parenting behavior (Holmbeck, 1997). Because TBI has the potential to profoundly alter a child's cognition and behavior and exacerbate parental distress, we further hypothesized that the relationship between child behavior and parental responsiveness would be more disrupted after TBI than after OI; in other words, we explored whether injury type would moderate the relationship between child and parent behavior (Objective c). To our knowledge, this is one of the first investigations to examine changes in parent–child interactions arising from TBI through the use of observational methods.

Method

The study used a concurrent cohort research design to assess young children with TBI and young children with OI and their families during the initial weeks following injury. Including children with OI as a comparison group allowed us to examine the consequences of brain injury relative to the functioning of a group of children who were likely to be similar in preinjury behavior and associated risk factors. Specifically, impulsive child behavior and social environmental characteristics such as the degree of parental supervision and monitoring have been shown to contribute to the risk for injury (both TBI and OI) and may also relate to preinjury parent–child interactions (Goldstrohm & Arffa, 2005). Additionally, the use of an OI cohort equated the groups with respect to the family stressor of having a child hospitalized. The study was approved by the institutional review boards at each of the participating medical centers, and informed consent was obtained from participating caregivers.

Recruitment Criteria

Consecutive admissions of children with TBI or with OI not involving the CNS were screened at three tertiary care children's hospitals and a general hospital (all with Level 1 trauma centers). Eligibility requirements for both groups included age between 36 and 84 months at the time of injury and English as the primary spoken language in the home. Eligibility for the TBI group also included a TBI requiring overnight admission to the hospital with a Glasgow Coma Scale (GCS) score of 12 or less or a higher score accompanied by evidence of abnormalities on imaging (magnetic resonance imaging [MRI] or computed tomography [CT] scan). GCS scores are generated by summing ratings of eye opening, best verbal response, and best motor response at the time of evaluation by medical staff (Teasdale & Jennett, 1974). Children who sustained nonblunt head trauma (e.g., projectile wounds, strokes, drowning) were excluded. Inclusion in the orthopedic group required a documented bone fracture (other than the skull) requiring an overnight hospital stay and the absence of any evidence of loss of consciousness or other findings suggestive of brain injury (e.g., symptoms of concussion). Exclusion criteria for both groups included previous history of brain injury, preexisting neurological disorder or medical problem affecting the CNS, diagnosis of MR or developmental disability, documentation in the medical chart or in the parent interview of child abuse as the cause of injury, and history of severe psychiatric disorder requiring hospitalization.

Sample Characteristics

A total of 206 children and their caregivers (87 parent–child dyads with TBI and 119 with OI) completed informed consent and were enrolled in the study. Baseline data were collected on 204 children and caregivers (87 parent–child dyads with TBI and 117 with OI). The sample included 54% of potentially eligible children with TBI and 35% of eligible children with OI. Comparison of enrolled children with those in the trauma registry at participating hospitals meeting age and injury severity criteria indicated that our sample was representative of all eligible children in terms of race and family income (based on median income from the 2005 census for the child's address obtained from the Web site at http://www.ffiec.gov/Geocode/default.aspx). All but 6 children (95%) completed the videotaped interaction tasks at the baseline assessment. Of these 6, 3 were unable to be assessed because of the severity of their injuries, and 3 declined to be videotaped. An additional 4 children had unusable videotapes and were thus excluded from the analyses. Those who failed to complete the task or who did not have usable data did not differ from those completing the task with respect to type of injury, injury severity, parental marital status, race/ethnicity, or child gender. However, the 3 children with severe TBI who were unable to participate had significantly longer hospital stays (M = 36.67 days, SD = 48.29) than the 20 children with severe TBI who completed the video interaction task (M = 6.70 days, SD = 7.24), suggesting that the severe TBI group was not representative of the entire spectrum of severity of TBI in those enrolled. The primary caregiver was the child's mother in all but eight families (96%). In these families, fathers (three), grandmothers (four), or permanent legal guardians (one) served as the primary caregiver and completed the parent–child interaction task.

Table 1 presents the injury severity and demographic characteristics of the children who completed the interaction task at baseline. Consistent with previous investigations (Fletcher, Ewing-Cobbs, Miner, Levin, & Eisenberg, 1990), severe TBI was defined as one resulting in a GCS score of 8 or less at any point since injury, and moderate TBI was defined as a GCS score of 9–12. Injuries receiving a GCS score of 13–15 accompanied by evidence of brain insult on neuroimaging (CT or MRI) were labeled as complicated mild TBI. We refer to the latter group as *complicated mild* because positive neuroimaging results signify a more significant brain injury than is typical for persons sustaining mild TBI (Malec et al., 2007). Children with TBI were more seriously injured and hospitalized longer than children with OI. Children in the complicated mild TBI group had a significantly higher mean Injury Severity Score (ISS; Baker, O'Neill, Haddon, & Long, 1974) than those in the OI and moderate TBI groups, indicating that the children in the complicated mild TBI group had more frequent lesions on neuroimaging. The higher ISS for the complicated mild TBI group thus reflects higher component ratings for both the head region and other body regions. Children with severe TBI were hospitalized longer than the other groups.

The TBI and OI groups did not differ from each other with respect to preinjury delays in growth and development (9% TBI and 10% OI), learning difficulties (3% TBI and 3% OI), emotion or behavior problems (7% TBI and 7% OI), or previous developmental evaluation (16% TBI and 18% OI). These data suggest that the TBI and OI groups did not differ with respect to preinjury developmental or behavioral problems. The groups did, however, differ in the proportion of non-Caucasian parents. There were also trends for differences in family income and parental education. Thus, to control for the possible influence of sociodemographic factors on observed parent and child behaviors, median census tract income and parent race were included as covariates in the analyses of group differences.

Procedure

The present study is based on data collected at the initial (baseline) assessment, which was a mean of 39.99 days post injury (*SD* = 19.38). The time between injury and assessment was longer for the TBI group than for the OI group: *M* = 49.90 days (35.35) for the TBI group, and *M* = 35.40 days (14.89) for the OI group, $t(218) = 110.12$, $p < .000$. This difference was likely related to longer hospital stays and difficulties recruiting and testing the children acutely following TBI. The videotaped observation of parent–child interactions was completed midway through a comprehensive neuropsychological and behavioral evaluation of the child.

Measures

Ratings of parent and child behavior—Because parent–child interactions vary depending on the context, similar to previous investigations (e.g., Barkley, 1991), we videotaped interactions in two contexts: (a) unstructured free play and (b) a structured teaching task. During the 10-min free play interaction, the parent was instructed to spend time with his or her child as if they were at home. The room was equipped with developmentally appropriate toys as well as magazines for the parents to read. During the 10-min teaching task, the parent and child were asked to complete a series of puzzles together. Parents were instructed to find a puzzle that they thought would be somewhat difficult for their child to ensure the need for assistance. The play and teaching task portions were each divided into two 5-min segments for rating purposes and transcribed to facilitate coding of caregiver and child verbalizations.

To rate parent and child behaviors, we employed the coding system used by Landry and colleagues (1990, 1997) in their studies of outcomes in low-birth-weight children. This system incorporates ratings of parent and child behaviors that reflect more enduring dispositions or interactive styles (Bakeman & Brown, 1980) and frequency counts of parental behaviors that support, direct, or restrict the child's behavior. Considerable support exists regarding the predictive validity of these ratings for subsequent child cognitive and social development (Landry et al., 1997, 2001; Landry, Miller-Loncar, Smith, & Swank, 2002).

Parent behavior during both the free play and the teaching task was coded along the dimensions of warmth, contingent responsiveness, and negativity. Each dimension was rated along a 5-point scale, with higher scores indicating more positive behavior (i.e., high warmth, minimal negativity). Parental warmth was rated on the basis of the presence and intensity of verbal and nonverbal warmth, affection, and positive regard toward the child as characterized by physical engagement and proximity, encouragement and praise, positive conversation, enthusiasm, physical affection, acceptance, and a sense of joy and pleasure in interacting with the child. Contingent responsiveness reflected the parent's sensitivity and responsiveness to the child's behavior and was rated on the basis of the presence and frequency with which the parent responded to the child's initiation, allowed the child to direct activities, displayed sensitivity to the child's cues and affective signals, and modulated speech, affect, and the pace of activities to fit with those of the child. Negativity was rated on the basis of the presence of a harsh or angry tone of voice, sarcasm and demeaning comments, physical control such as slaps or pinches, and physical expressions of impatience (eye rolling, sighing).

Raters also counted the frequency of three distinct parental behaviors that have been shown to influence subsequent child development: restrictions, directives, and scaffolding behaviors (Assel, Landry, Swank, Smith, & Steelman, 2003; Landry et al., 2002). Restrictions were defined as verbal or nonverbal parental behaviors that limited, restricted, or disciplined the child's behavior in some way. Directives were defined as verbal or nonverbal strategies that provided structure while limiting the child's choices (e.g., "Put the blue block there"). Scaffolding behaviors provided verbal or semantic links between objects, persons, activities, or functions, thereby facilitating the child's understanding and problem solving (see Landry et al., 2002, for a more complete definition of scaffolds).

During the free play interaction, coders rated the child's warmth/engagement toward the parent on the basis of the amount of talking, eye contact, smiling/positive affect, and verbal and nonverbal efforts to engage the parent. During the teaching task, coders rated the child's cooperation and behavioral regulation. As with the caregiver ratings, child ratings were based on a 5-point scale, with higher ratings reflecting more socially appropriate behavior (more cooperation, better behavior regulation).

Each 5-min segment was coded independently. Subsequently, ratings for the two play segments were averaged, and ratings for the two teaching segments were averaged, thereby increasing the stability of our measures. Although raters were not informed of the group status of parent–child dyads, some children in both groups had casts indicative of OI, and some children with severe TBI had visible speech or motor impairments associated with their injuries. Therefore, it was not possible to completely conceal the nature of the injury from the raters.

Raters were trained on one or two codes at a time over a period of several months. Reliability on a given code was determined by the rater's ability to independently rate five tapes with an overall reliability/agreement above 85%. Ongoing reliability for each rater was assessed at monthly supervision meetings. To assess interrater reliability, 15% of the tapes were rated by the entire rating team. Each rater's reliability with the group ratings was assessed using intraclass correlation coefficients (ICCs). Reliability was required to remain at or above 85% or retraining was implemented. All ICCs were .80 or greater (range .80–.99), indicating a high level of interrater reliability.

We examined intercorrelations among the rating scales to determine if the ratings were capturing distinct behaviors (see Table 2). Scales with correlations exceeding .75 were averaged to form composites. On the basis of this criterion, warmth and contingent responsiveness were averaged into a single scale of warm responsiveness reflecting positive parenting behavior during the play and teaching segments (see also Landry, Smith, & Swank, 2006). Parent negativity was not highly correlated with positive parenting behaviors and was thus retained as a separate scale. Child warmth was correlated with behavior regulation and cooperation .22 and .18, respectively. Child behavior regulation and cooperation were correlated .67, and therefore, each was examined as an independent rating.

Parental depressive symptoms—Parental depressive symptoms were assessed using the depression scale of Brief Symptom Inventory, a 53-item questionnaire tapping a wide range of psychological symptoms. Reliability and validity have been well established (Derogatis & Spencer, 1982). Previous research with depressed caregivers indicated that parental depression is associated with lower levels of warmth and greater negativity (Dyer-Harnish, Dodge, & Valente, 1995; Elgar, McGrath, Waschbusch, Stewart, & Curtis, 2004; Haskett & Willoughby, 2006). The groups did not differ significantly with respect to levels of depressive symptoms at baseline (severe TBI = 53.37; all other groups had T scores of 49–50). The groups also did not differ on the proportion of individuals meeting clinical caseness indicating clinically significant levels of depressive symptoms (severe TBI = 24.0%; moderate TBI = 10.0%; complicated mild TBI = 9.0%; OI = 9.3%).

Analyses

Repeated measures general linear model analyses were conducted to examine group differences in ratings and frequency counts of parental behaviors. In these analyses, the situation (play vs. teaching task) served as the repeated measures factor. Parent race and median census tract income served as covariates to control for group differences in these characteristics (i.e., race, income). Partial eta squared provided an estimate of effect sizes.

We conducted multiple regression analyses to examine the contribution of maternal depressive symptoms and child behavior (regulation and cooperation) to parental behaviors. The TBI injury group was divided into three subgroups depending on the severity of injury. We included ratings of parent–child relationships from the teaching task because we anticipated more pronounced differences in child behavior between the injury groups in this structured context. Parental behaviors of interest included warm responsiveness, directiveness, and scaffolds. Because the frequency counts of directives and scaffolds were not normally distributed, we used log transformations as the dependent variables in the regression analyses. Separate regressions were conducted, with child cooperation and child behavior as predictors because of the relatively high correlation between the two.

For the predictor variable child behavior regulation, the full model included the interaction between child behavior and injury group; the three variables of interest: parental depression, child behavior and injury group; and two covariates: income and race. If the interaction was not significant, it was removed from the model. The three predictor variables and the two covariates were maintained in the model whether they were significant or not.

Effect sizes were calculated for each of the predictor variables and the two covariates using Cohen's f^2 (Cohen, 1992). Additional analyses were conducted to determine whether child's behavior mediated the effect of injury group on parental response. Separate regression analyses were conducted for each TBI group and OI group combination to verify that the following conditions of mediation were met: (a) Parental behavior was significantly associated with injury group, (b) parental behavior was significantly associated with the child's behavior, (c) the child's behavior was significantly associated with injury group, and (d) parental behavior was significantly associated with injury group after controlling for child behavior. If all four steps were met, then child behavior was considered a mediator if the change in the coefficient for injury group between Steps a and d was 10% or greater.

Analysis for the predictor variable child cooperation was conducted in the same manner as described for child behavior. SAS software Version 9.1 was used. The PROC GLM procedure was used for all of the regressions analyses. The PROC UNIVARIATE procedure was used to examine the distributions of the response variables and the residuals. All tests were two-way tests, and *p* values less than 0.05 were considered significant.

Results

Group Differences in Parent–Child Interactions

Results reported in Table 3 revealed that parents of children with TBI exhibited less warm responsiveness than parents of children with OI. Specifically, parents of children with complicated mild TBI were rated as less warmly responsive than parents of children with OI during both the free play and teaching tasks; parents of children with moderate TBI were rated as less responsive than those of children with OI only during the teaching task. During the teaching task, parents in the severe and complicated mild TBI groups made more directive statements than did parents in the OI group, Group × Situation interaction, $F(3, 181) = 2.78$, $p = .04$. Parents in the severe TBI group also made more scaffolding statements during the teaching task than did parents of children with OI. The groups did not differ on ratings of negativity or on the number of restrictions. Regardless of the severity or nature of the injury, parents made restrictive statements more frequently, $F(3, 181) = 23.80$, $p = .000$, and were rated as more negative, $F(3, 181) = 7.57$, $p = .007$, during the teaching task than during the free play.

Also consistent with hypotheses, observers rated children with severe and complicated mild TBI as significantly less well regulated than children with OI (see Table 4). However, the groups did not differ on ratings of warmth or cooperation.

Mediators and Moderators of Parental Behavior

We conducted multivariate analyses to test two distinct hypotheses. First, we sought to examine whether parental depression and child behavior mediated the association between TBI and parental behaviors toward the child. We examined warm responsiveness, directives, and scaffolds during the teaching task as outcomes in this context because preliminary general linear model analyses provided evidence of group differences on these behaviors (see Table 3). A 10% reduction in the significance of group differences after entering the putative mediator in the model would provide evidence of mediation. Second, we sought to test whether the association between the child's behavior and the parent's response (i.e., warm responsiveness) varied as a function of the nature and severity of the child's injury (moderation model). We entered interaction terms involving group and child behavior (regulation, moderation) as predictors of parent behaviors. Significant interaction terms would indicate that injury type moderated the relationship between child and parent behaviors. Table 5 presents the findings of these analyses.

Models of parent warm responsiveness—After controlling for parental race and income, the child's behavior regulation accounted for significant variance in parental warm responsiveness; however, parental depressive symptoms did not. Behavior regulation mediated the association between the type of injury and parental responsiveness when the complicated mild TBI and OI groups were being compared. The effect sizes for the child's behavior regulation and injury group were comparable (Cohen's f^2 = .10), whereas income and race accounted for less variance (f^2 = .04). We did not find evidence that the nature and severity of the injury moderated the relationship between the child's behavior regulation and the parent's warm responsiveness (p = .1322).

When considering the ratings of the child's cooperation as the index of child behavior in the model, we found a significant interaction between ratings of cooperation and injury group. In these interactions, the child's cooperation was significantly correlated with the parent's responsiveness in the OI group, accounting for 23% of the variance after controlling for sociodemographic factors and depression. However, child cooperation was not related to parental warm responsiveness in any of the TBI groups. These findings suggest that TBI may disrupt the natural reciprocity that is found between parent and child behaviors.

Models of parental directiveness—After controlling for parental race and income, the child's behavior regulation accounted for significant variance in parental directiveness; however, parental depressive symptoms did not. Injury group was no longer a significant predictor with child behavior regulation in the model. The interaction of behavior regulation and group was not significant (p = .3543), indicating that the type of injury did not moderate the association between child behavior regulation and parental directiveness. However, behavior regulation mediated the association between the type of injury and parental directiveness when the complicated mild TBI and OI groups were being compared. We found similar results when ratings of the child's cooperation were considered. Specifically, group was no longer a significant predictor of parental directiveness with child cooperation in the model. There was also no evidence of moderation (p = .98).

Models of parental scaffolding—Neither parental depressive symptoms nor child behavior regulation was significantly associated with parental scaffolds after controlling for income and race. Thus, child behavior regulation did not mediate the relationship between injury type and parental scaffolds or cognitive supports. Both parental income and injury group had comparable effect sizes (Cohen's f^2s = .05 and .06, respectively). The interaction of behavior regulation and group was not significant (p = .25), indicating that the type of injury did not moderate the association between child behavior regulation and parental scaffolds. We found a similar pattern of findings with child cooperation in the model, with no support for the mediation or moderation hypotheses.

Discussion

The present article provides preliminary support for the three major hypotheses of this study. Comparisons of parent–child dyads following TBI with parent–child dyads following OI constitute the first observational evidence that parent–child interactions may be affected in the initial months following TBI. Although some group differences (e.g., lower levels of warm responsiveness) suggest adverse changes in parent–child interactions, others (e.g., more frequent parental scaffolds following severe TBI) indicate positive adaptation to the child's injury. As anticipated, children with severe and complicated mild TBI were rated as displaying less self-regulation during structured activities. We found evidence that these differences in the child's behavioral regulation partially mediate observed differences in parental responsiveness and directiveness. Moreover, the relationship between the child's level of cooperation and parent responsiveness varied as a function of the nature of the injury, such that parent warm responsiveness was less contingent upon the child's behavior following TBI than following OI. Further longitudinal investigation is needed to clarify the persistence and magnitude of the observed differences in parent–child interactions. However, these findings provide tentative evidence that TBI may disrupt parent–child relationships, contributing to a lack of reciprocity or synchrony between parent and child behavior. The importance of each of these findings is discussed below.

The finding that parents of children with moderate and complicated mild TBI exhibited less warm responsiveness has potentially important implications for children's recovery and subsequent development. Although modest in magnitude, the nature/severity of the child's injury accounted for more variance (12%) in parental responsiveness during the structured task than race and family income combined (7%). An extensive and growing developmental literature underscores the importance of parental warm responsiveness for the subsequent growth of social competence and cognitive and language abilities in the child (Landry et al., 2001; Weizman & Snow, 2001). In fact, successful early intervention programs appear to influence child cognitive and language development through increases in parental responsiveness to the child (Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998; Mahoney, Wheeden, & Perales, 2004). Although early warm responsiveness has been shown to be particularly important, recent research suggests that children who receive consistently warm responsive parenting over time exhibit better cognitive development than those who never receive warm responsive parenting or who only receive it during early development (Smith, Landry, & Swank, 2006). Thus, future research is needed to determine whether these differences in parental responsiveness persist and if they contribute to subsequent decrements in both cognitive and social-emotional development.

Interestingly, the greatest differences in warm responsiveness were found between the OI and the complicated mild and moderate TBI groups, rather than between the OI and severe TBI groups. This finding is in part accounted for by the fact that the complicated mild TBI group had greater injury acuity, as measured by the ISS, than any of the other groups. Additionally, the three most severely injured children were unable to complete baseline assessments, thereby reducing the sample size and partially masking the effects of severe TBI on parent–child interactions. However, these findings also underscore the need to understand the impact of TBI among children with presumably less severe injuries.

Group differences were also greater in the context of the structured teaching task, suggesting that the influences of TBI on parent–child interactions may be situationally specific, with negligible effects in unstructured settings. Similarly, observational studies have found that children with attention-deficit/hyperactivity disorder differed from controls more in structured, rather than free play, situations (Danforth, Barkley, & Stokes, 1991; Johnston & Mash, 2001), in part because parents made greater demands for compliance and had fewer opportunities for positive parenting in this context (Chronis et al., 2007).

Our findings suggest that parents do not become more critical toward their children during the initial weeks following TBI, contradicting some previous studies of children with other conditions (Floyd & Zmich, 1991; Pipp-Siegal & Biringen, 1998). Additionally, although parents of children with TBI were more likely to tell their child what to do, they were not more likely to restrict their behavior. Given that parents of children with severe TBI were also more likely to make statements or verbal scaffolds to facilitate the child's cognitive performance, our findings support the possibility that parents are trying to respond effectively to their child. This possibility is considered more fully in the discussion of the evidence of mediation.

Contrary to expectations, parental depressive symptoms were not related to warm responsiveness after controlling for census-based income and race. Because depressive symptoms were correlated with income and race, controlling for these factors before examining the effects of depression may have obscured the influence of parental psychological adjustment on responsiveness. The fact that only modest zero-order correlations were found between depressive symptoms and warm responsiveness (see Table 2) provides limited support for this possibility. Additionally, the groups did not differ in mean levels of depressive symptoms or in the proportion of parents with clinically significant depressive symptoms (Stancin, Wade, Walz, Yeates, & Taylor, in press). In a recent study, Haskett and Willoughby (2006) reported similar findings regarding the relationship between maternal depression and parenting behaviors. In their study, depression was only a significant predictor when the level of depression was clinically significant. In the current study, only 11% of parents reported clinically significant symptoms, making it unlikely that significant depression would explain differences in responsiveness in the current cohort. Thus, the relationship between parental depression and warm responsiveness may be more complex than initially thought.

A second possible mechanism of effect involves influences of the child's temperament and ability to self-regulate on parental sensitivity and responsiveness (Vaughn & Bost, 1999). Because TBI adversely alters child behavior and self-regulation, we anticipated that child behavior would influence parental warm responsiveness, with less child regulation and cooperation resulting in less parental warm responsiveness. This expectation was partially supported. The child's behavior regulation partially mediated the association between the injury group and parental warm responsiveness, suggesting that parents of children with TBI are responding differently to their children in part because of differences in their child's ability to self-regulate. Child behaviors also mediated the association between injury group and parental directiveness, providing further evidence that observed differences in parenting are driven, in part, by differences in the child's behavior. However, the fact that group remained a significant predictor of parental responsiveness with child behavior regulation in the model indicates that changes in the child's behavior do not fully explain observed group differences in parental warm responsiveness.

We also found, in the case of the child's level of cooperation, that the nature and severity of the injury moderated the association between the child's behavior and the parent's warm responsiveness. Specifically, no relationship was found between child cooperation and parental warm responsiveness in the TBI group, suggesting a disruption in the feedback loop between parent and child. These findings suggest that child behavior influences parent warm responsiveness to some extent following TBI but that TBI may also alter the reciprocity between parent and child.

Although reasons for this disruption are unclear, parents may spend more time structuring and directing the child's behavior following TBI even when the child is relatively well regulated, allowing for fewer opportunities to be warmly responsive to the child's needs and wants. Our finding that parents in the TBI group made more statements that directed the child's behavior during the teaching task is consistent with this possibility. Furthermore, in a recent review of the impact of developmental disabilities on parent–child interaction and attachment, Howe (2006) concluded that disabilities that affect communication or create difficulties in interpreting the child's needs and behavior are likely to result in less responsive caregiving. Thus, the reciprocity between parent and child may become disrupted following TBI by an increased need for maternal direction of the child's behavior accompanied by difficulties in reading the child's signals. Anecdotally, many parents report that it feels as though they have a new child after a major brain injury. Therefore, the parent may have greater difficulty interpreting the child's cues and responding appropriately. The finding that parents of children with severe TBI made more verbal statements (scaffolds) to facilitate the child's problem solving than did those in the OI group suggests that parents may be trying to be responsive to their child's changing needs. In other words, TBI may have precipitated changes in the nature of the parent–child reciprocity rather than less responsive parenting (Floyd & Costigan, 1997).

Because we did not examine parental stereotypes or overprotection, our findings do not preclude the possibility that changing parental perceptions of the child, unrelated to the child's actual behavior, influenced the parent's actions toward the child (Holmbeck et al., 2002; Stern et al., 2000). Parental stereotypes regarding TBI could account for the reduced reciprocity between child and parent in the TBI group. However, if parents of children with TBI are behaving differently toward their child because of assumptions or stereotypes regarding the effects of brain injury, these differences should diminish over time as the parent develops a clearer understanding of how TBI has affected his or her own child (Stern et al., 2000). Thus, research is needed to understand how group differences in parenting behaviors change over time.

We included race and income in the models to control for their influences prior to examining group effects and potential mediators. Notably, race and income were associated with some of the parenting behaviors, accounting for significant variance in parental responsiveness and negativity but not in directives and restrictions. These findings are consistent with previous investigations indicating that social and demographic characteristics influence parental response to TBI (see Yeates et al., 2002). Although more extensive consideration of racial and SES influences on parenting is beyond the scope of the current article, we should note the importance of considering demographic, cultural, and injury-related characteristics that influence parental beliefs and behavior when working with families following TBI.

Several limitations should be noted. First, the coding system used a combination of global ratings and behavioral counts. An interval coding system that could capture the parent's response to specific acts of child compliance or noncompliance may have provided greater sensitivity to changes in parent–child interaction arising from TBI. Second, the families of children with TBI and the families of children with OI differed on several background characteristics, including median family income and parent race, which were related to parent–child interactions. Although we failed to detect any recruitment bias and controlled for background factors in the analysis, group differences in demographic characteristics may have contributed to observed differences in parent–child behaviors. Third, parent–child interactions may have differed by group prior to the injury, though the groups did not differ on retrospective reports of preinjury family functioning or preinjury child behavior (Stancin et al., in press). Finally, the lack of parent report regarding present child behavior constitutes a limitation; however, we will be able to examine postinjury child behavior in relation to parent–child interactions as part of subsequent follow-up assessments of the sample.

These findings have potentially important implications for understanding recovery following TBI in young children and for developing interventions to improve outcomes. Previous research suggests that parental warmth and responsiveness facilitate cognitive growth and development, whereas parental direction and control hamper it, with the parent’s contingent responsiveness to the child providing feedback that is essential for social and emotional development (Ainsworth, Blehar, Waters, & Wall, 1978; Landry et al., 2001; Smith et al., 2006). Furthermore, children with neurological risk factors, such as TBI, may benefit more from warm responsive parenting (Landry, Garner, Swank, & Baldwin, 1996). Thus, the relationship between warm responsive parenting and recovery from TBI needs to be examined over time. Specifically, does the apparent decrement in parent–child reciprocity persist over time, and does it contribute to less recovery and poorer subsequent development in language, cognitive abilities, and social competence? Alternatively, does parental warm responsiveness moderate social and cognitive outcomes over time, with consistently high levels of warm responsiveness predicting a better recovery trajectory in the TBI group? By following these children over time, we will be able to determine the role of warmly responsive parenting across short- and long-term recovery following TBI. Recent studies with parents of children with very low birth weight have shown that these parenting behaviors can be increased through intervention, resulting in improved cognitive development (Smith, Landry, & Swank, 2005). These findings raise the possibility that parenting interventions could be adapted to improve developmental outcomes following pediatric TBI.

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Table 1

Demographic and Injury Characteristics

Characteristic	Severe TBI	Moderate TBI	Complicated mild TBI	OI	F/χ^2
Census income	$53,153.60 (15,503)	$53,885.62 (33,991)	$58,264.41 (22,746)	$63,585.46 (23,688)	1.79
Education					5.04
≤ High school graduate	15 (75%)	12 (57.1%)	20 (51.3%)	50 (44.2%)	6.95
>High school graduate	5 (25%)	9 (42.9%)	19 (48.7%)	63 (55.8%)	
Percentage non-White	6 (30%)	10 (47.6%)	9 (23.1%)	17 (15%)	12.09***
Child's age	4.74 (.88)	5.22 (1.17)	4.89 (1.24)	5.14 (1.07)	6.95
Child's gender: male (% male)	14 (70%)	12 (57.1%)	25 (64.1%)	64 (56.6%)	1.69
ISS[a, b, c]	12.47 (8.57)	12.10 (9.55)	16.72 (6.62)	7.02 (2.67)	36.63***
Loss of consciousness (%)	15 (75%)	13 (61.9%)	11 (28.2%)		
Days hospitalized[a]	6.70 (7.24)	2.50 (2.12)	2.95 (1.69)	1.63 (1.10)	12.39***

Note. Numbers in parentheses are standard deviations. TBI = traumatic brain injury; OI = orthopedic injuries; ISS = Injury Severity Score (Baker, O'Neill, Haddon, & Long, 1974).

[a]Severe TBI group > OI group; $p < .05$.

[b]Moderate TBI group > OI group; $p < .05$.

[c]Complicated mild TBI group > OI group; $p < .05$.

*** $p < .001$.

Table 2

Intercorrelations of Ratings of Parent Behaviors and Parental Depression

	Play			Teaching task		
Parent behavior/distress	**Warm**	**Responsive**	**Negative**	**Warm**	**Responsive**	**Negative**
Play						
Warm	1.00	.80	.26	.66	.55	.19
Responsive		1.00	.33	.63	.66	.25
Negative			1.00	.27	.30	.57
Teaching task						
Warm				1.00	.84	.33
Responsive					1.00	.42
Negative						1.00
BSI-Dep	−.12	−.15	−.10	−.10	−.18	−.16

Note. BSI-Dep = Brief Symptom Inventory depression scale. All correlations < −.14 or > .14 were significant at $p < .05$.

Table 3

Group Comparisons of Ratings of Parent Behaviour

	Severe TBI		Moderate TBI		Complicated mild TBI		OI			
Parent behavior	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F* (3, 183)**	**Partial η^2**
Parent play										
Warm responsiveness[a]	3.09	0.90	2.72	0.97	2.78	0.97	3.29	0.87	2.92*	.05
Negativity	4.82	0.48	4.90	0.26	4.78	0.30	4.75	0.50	2.03	—
Scaffolds	10.37	6.70	8.10	6.08	9.26	7.97	9.29	6.46	0.44	—
Directives	13.84	8.50	10.05	7.56	8.26	7.75	8.88	7.89	2.11	—
Restrictions	3.53	2.81	3.57	3.20	2.64	3.91	2.60	2.81	0.89	—
Parent teaching task										
Warm responsiveness[a,b]	2.97	0.81	2.43	0.80	2.78	0.95	3.44	0.88	8.34***	.12
Negativity	4.75	0.57	4.68	0.43	4.58	0.67	4.66	0.61	0.64	—
Scaffolds[c]	17.15	10.00	9.81	8.84	14.68	10.35	13.63	7.50	2.78*	.04
Directives[a,c]	22.70	15.86	16.67	13.02	21.55	17.11	15.12	13.52	2.67*	.04
Restrictions	6.10	6.07	4.95	3.60	7.11	11.50	3.83	5.93	2.45	—

Note. Parental race and census tract income served as covariates in each of the analyses. Parent play indicates that these ratings were from the free play segment. Parent teaching task indicates that these ratings were from the teaching task segment. Warm responsive and negativity ratings were on a 5-point scale (range 1–5), with higher scores corresponding to more positive behavior (e.g., greater responsiveness, less negativity). Scaffolds, directives, and restrictions were counts of the frequency of those behaviors summed across the two 5-min play and teaching task segments. Dashes indicate that effect sizes were not reported for nonsignificant group comparisons. TBI = traumatic brain injury; OI = orthopedic injuries.

[a] Complicated mild TBI > OI; $p < .05$.

[b] Moderate TBI > OI; $p < .05$.

[c] Severe TBI > OI; $p < .05$.

* $p < .05$.

*** $p < .001$.

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Table 4

Group Comparisons of Ratings of Child Behaviour

	Severe TBI		Moderate TBI		Complicated mild TBI		OI			
Child behavior	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F* (3, 183)**	**Partial η^2**
Warmth	3.30	0.89	3.35	0.82	3.08	1.11	3.54	0.86	2.25	—
Cooperation	3.65	1.20	4.15	1.05	3.83	1.14	4.15	0.87	2.41	—
Behavior regulation[a,b]	4.33	1.15	4.80	0.35	4.48	0.89	4.85	0.46	5.87***	.09

Note. Parental race and census tract income served as covariates in each of the analyses. Child warmth, cooperation, and behavior regulation ratings were on a 5-point scale (range 1–5), with higher scores corresponding to more positive behavior (e.g., greater warmth, higher levels of cooperation). Dashes indicate that effect sizes were not reported for nonsignificant group comparisons. TBI = traumatic brain injury; OI = orthopedic injuries.

[a] The severe TBI group was significantly different from the OI group ($p < .05$).

[b] The complicated mild TBI group was significantly different from the OI group ($p < .05$).

*** $p < .001$.

Table 5

Multivariate Analyses Testing Effect Size and Mediation Models for Parental Responsiveness, Directiveness, and Scaffolds

Parent behavior	Variable	Type III SS	*F*	*df*	f^2
Warm responsiveness	Race**	4.36	6.88	(1, 181)	.04
	Income**	5.15	8.11	(1, 181)	.04
	Depression	0.59	0.93	(1, 181)	—
	Behavior regulation***	11.85	18.67	(1, 181)	.10
	Group***	3.72	5.87	(3, 181)	.10
	Group without[a]***	5.10	7.33	(3, 182)	.12
Directiveness	Race	2.75	3.87	(1, 179)	—
	Income	0.40	0.57	(1, 179)	—
	Depression	1.37	1.92	(1, 179)	—
	Behavior regulation***	16.64	23.43	(1, 179)	.13
	Group[b]	2.72	1.27	(3, 179)	—
	Cooperation[c]	17.12	24.20	(1, 179)	.14
	Group[d]	4.51	2.12	(3, 179)	—
	Group without[a]*	8.76	3.65	(3, 180)	.06
Scaffolds	Race	1.39	2.93	(1, 178)	—
	Income**	3.95	8.30	(1, 178)	.05
	Behavior regulation	0.39	0.83	(1, 178)	—
	Group[b]*	4.91	3.45	(3, 178)	.06
	Cooperation[c]	0.04	0.08	(1, 178)	—
	Group[d]*	4.38	3.06	(3, 178)	.05
	Group without[a]*	4.57	3.21	(3, 179)	.05

Note. SS = sum of squares.

[a]Indicates the effects of injury group without either of the child behavior variables in the model.

[b]Indicates the effects of injury group with behavior regulation in the model.

[c]The contributions of child cooperation and behavior regulation were analyzed in separate analyses.

[d]Indicates the effects of injury group with cooperation in the model.

* $p < .05$.

** $p < .01$.

*** $p < .001$.