

Rough-and-Tumble Play and the Development of Physical Aggression and Emotion Regulation: A Five-Year Follow-Up Study

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Abstract This is a follow-up to a study demonstrating that rough-and-tumble play was related to physical aggression in the preschool years. Fathers reported on the frequency of father-child rough-and-tumble play interactions, and the degree to which fathers were dominant in the play dyad was observed and coded from play interactions. In this follow-up study, school-aged children's physically aggressive behaviors and emotion regulation abilities were assessed with questionnaires 5 years later. Higher frequencies of father-child rough-and-tumble play in the preschool years were associated with more physical aggression and worse emotion regulation 5 years later for children whose fathers were less dominant,

over and above the effects of physical aggression in the preschool years. Rough-and-tumble play was unrelated to these measures among children whose fathers were more dominant during play. This study shows that early rough-and-tumble play continues to be related to children's psychosocial adjustment over time, and that the effect remains moderated by the quality of the father-child relationship during play.

Keywords Rough-and-tumble play · Aggression · Emotion regulation · Dominance · Father · Development

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Physically aggressive behaviors, such as hitting, kicking, pushing, and biting, are observable as early as 18 months of age (Tremblay et al. 1999; Tremblay et al. 2004), but typically begin to decline through the preschool years (Côté et al. 2006). This decline is likely due to the development of the self-regulatory abilities that serve to inhibit physical aggression and develop more socially appropriate alternatives (Bongers et al. 2004; Côté et al. 2007; NICHD Early Child Care Research Network 2004; Tremblay et al. 1999; Tremblay et al. 2004). Unfortunately, some children fail to develop these self-regulatory abilities and by kindergarten. These children are at risk for chronic psychosocial problems later in life including adult crime, alcoholism, drug abuse, unemployment, divorce, and mental illness (Broidy et al. 2003; Frick 2001; Loeber and Hay 1997; Moffitt et al. 1996; Rutter 1996). In response to these data, Tremblay (2000, 2006) has argued that an important step in the prevention of chronic physical aggression is helping children at risk learn to regulate their aggressive behavior.

Parents can help their children learn to regulate their own behavior through physical play, which is an important component of human socialization (Barth and Parke 1993;

Kerns and Barth 1995; Lindsey et al. 1997; MacDonald 1993; MacDonald and Parke 1984; Parke et al. 1988). This appears to be especially true for fathers (Carson and Parke 1996; Lindsey et al. 1997; MacDonald and Parke 1984), in contrast to mothers who engage primarily in cognitive object-mediated play and role-playing (Crawley and Sherrod 1984; MacDonald and Parke 1986). Fathers are the preferred play partner of preschool-aged boys and girls (Roopnarine et al. 1993), and physical play is the preferred play activity with this caregiver (Sullivan and Lewis 1989). Father-child physical play has been linked to children's peer competence (Carson and Parke 1996; Lindsey et al. 1997; MacDonald and Parke 1984), emotion-regulation (Barth and Parke 1993; Carson and Parke 1996), and popularity (Corr et al. 1995).

Rough-and-Tumble Play

Rough-and-tumble play (RTP) is a form of physical play, commonly observed in fathers and children. It consists of the vigorous behaviors such as wrestling, grappling, jumping, tumbling, and running that would appear to be aggressive if not for the play contexts (Pellegrini and Smith 1998). RTP is the least studied form of human play, partly because many adults find it disruptive and dangerous (Panksepp 1993). As a result, little is known about the impact of father-child RTP on children's psychosocial development (Paquette 2004). This observation is consistent with a more general shortage of research on fathers and fatherhood (Parke et al. 2002).

Animal research has clearly demonstrated that RTP, albeit between peers, plays a significant role in the psychosocial development of young mammals, which raises the possibility that the same is true in humans. Juvenile rats deprived of play-fighting interactions with peers develop a variety of emotional and cognitive deficits, some associated with basic social competence (Von Frijtag et al. 2002). These findings were maintained even if the rats had ample opportunity for other kinds of social interactions (Einon and Morgan 1977). Furthermore, young rats that are given surgical lesions to their right prefrontal cortices become hyperactive, an effect that is largely reversed by abundant opportunities to engage in RTP (Panksepp et al. 2003). Finally, play fighting in rats dramatically activates the release of chemical growth factors in areas of the brain associated with social information processing (Gordon et al. 2003). These "brain fertilizers" appear to promote the growth and development of these areas (Gordon et al. 2003). One of these "fertilized" brain regions, the orbito-frontal cortex, is commonly associated with the regulation of social behavior and is important for RTP competence in rats (Pellis and Pellis 2007).

Unlike non-human animals who play with peers from very early in life (Panksepp 1998), young children primarily

play with their parents. The frequency of father-child RTP peaks in the late preschool years, whereas the frequency of peer RTP peaks in early adolescence (Pellegrini and Smith 1998). Interestingly, the period in which father-child RTP is most common corresponds with a period marked by great improvements in frontal lobe functioning, which is known to support the regulation of behavior and emotion (Zelazo et al. 1997; Séguin and Zelazo 2005). Thus, the preschool years may be an ideal period to stimulate the development of children's self-regulatory functioning.

Research on Rough-and-Tumble Play and Behavior Regulation in Children

Some research has begun to address the hypothesis that father-child RTP can contribute to the development of self-regulation in children. According to the model proposed by Peterson and Flanders (2005), father-child RTP presents children with unique self-regulatory challenges. It is an intense, exciting, and rough activity that can stimulate children to the edge of their emotion-regulation abilities. Yet, the activity is only sustainable as long as both parties are having fun, which means that individuals must modulate their emotion and behavior according to the needs of the play partner if play is to continue. Paquette (2004) has argued that by setting limits and modeling effective self-control in RTP, fathers can contain and support this behavior modulation. These researchers and others (Carson et al. 1993; Paquette et al. 2003) have emphasized that RTP may be a particularly fertile context for children to cultivate the ability to regulate both aggressive affect and behavior.

Flanders et al. (2009) tested the hypothesis that father-child RTP would be associated with less physical aggressive behavior in preschool-aged children, which theoretically reflects the development of their self-regulatory functioning. Fathers and their preschool aged children were observed during a free play session and father-reports about the children's physical aggression during the previous 12 months was collected concurrently. The study showed that the association between father-child RTP frequency and physical aggression was moderated by the degree to which the father was a dominant play partner. The strength of the positive relation between RTP activities and levels of physical aggression increased as fathers were less dominant in dyadic interactions. These findings were maintained after controlling for the sex and age of the child as well as more general factors in the father-child relationship including, the frequency of father-child play in general, and the overall amount of time the father spent with the child. Thus, if fathers fail to endorse their regulatory role (that is challenging and supporting their child learning in this domain) by

acting as submissive play partners, the hypothetically beneficial effects of RTP are lost.

Dominance in that study was defined in terms of a dyadic, affiliative relationship between individuals (Pellegrini et al. 2007), such that within a relationship one individual is more likely to have better access to resources or control over circumstances (Hawley 1999). Defined in this way, dominance is a highly relevant characteristic of human social behavior, and its observation in preschool aged children is particularly reliable (Hawley 1999). Children often use play interactions, especially RTP, to negotiate dominance among them (Pellegrini and Smith 1998). For example, during RTP, one individual typically has the upper hand, which may involve pinning, holding, pushing, or tickling. A child can assert dominance over a peer by using greater strength or “toughness” to hold the upper hand in RTP (Pellegrini and Smith 1998). This kind of physical prowess is typically important to a child’s social standing among peers at school, particularly for boys (Pellegrini 1995). In line with Paquette (2004), the results of the Flanders et al. (2009) study also suggests that it may also be important for a father to demonstrate physical and intellectual strength to his child in order to establish and maintain his authority with his children. This may be especially important with aggressive children: if they are able to attain the upper hand over their fathers in aggressive play, they may develop a distorted sense of what they can accomplish with aggression in other contexts.

Flanders et al. (2009) demonstrated an association between RTP frequency and physical aggression among less dominant fathers. These findings can be extended in two important ways. First, because physical aggression was measured concurrently with the play observations, little could be inferred about the role of RTP in the *development* of aggressive behavior. Typically, the frequency of physically aggressive behaviors decreases from the preschool to the school years as children’s self-regulatory functioning improves (Tremblay 2000, 2003) However, some children fail to develop these self-regulatory abilities and the frequency of these behaviors increases or remains stable through this period and their behavior is increasingly deviant relative to the behavior of their peers. Thus, to best characterize the risk of a child becoming chronically physical aggressive—and the set of risk factors associated with it—physical aggression must be assessed longitudinally. Thus, the current study employed a longitudinal design to test the hypothesis that RTP and dominance would indeed be related to the regulation of aggressive behavior over time.

Second, RTP has been hypothesized to influence psychosocial development more broadly than just the regulation of physically aggressive behavior. Several researchers (e.g., Panksepp 1998; Paquette 2004; Peterson

and Flanders 2005; Flanders et al. 2009) argue that the process of activating and regulating *emotion* during early RTP is an important component of these interactions. Early practice and parental support with this process should contribute to the development of the children’s ability to regulate emotions in every day life. This more general effect on emotion regulation abilities may only emerge over time, as the child consolidates the learning that take place during these interactions. Because RTP is an emotionally-charged context, the dominance dynamics of the play dyad are likely to be an important moderator once again. More dominant fathers are in a better position to model self-control and teach their children how to calm down if the children reach the edge of their self-regulatory competencies. Thus, the current study tested the hypothesis that RTP and dominance would be related to not only to physical aggression, but also to emotion regulation over time. This hypothesis is consistent with evidence from the animal literature that RTP stimulates the development of frontal lobe regions that support the processing of socio-emotional information.

Emotion regulation has been described as a set of abilities related to the processing of emotions and emotional information including the inhibition of emotional impulses, modulation of emotional behavior, maintenance of engagement with important elements of the world, and disengagement from distressing elements (Derryberry and Rothbart 1997; Grolnick et al. 2006; Posner and Rothbart 1998). Individual differences in emotion regulation are associated with social competence and personality development (Kochanska et al. 2000; Pellegrini and Smith 1998) and problems with emotion regulation processes have also been implicated in the etiology of a variety of psychopathologies (Cole et al. 1994; Zeman et al. 2006). However, the relationship between RTP and emotion regulation is hypothesized to be partly independent of the relationship between RTP and physical aggression. Although emotion regulation deficits have been implicated in the development of externalizing disorders (Beauchaine et al. 2007), aggressive behavior emerges from a complex set of underlying factors beyond emotion regulation specifically, including cognitive abilities, temperamental sensitivity to punishment and reward, and socio-cultural context (Loeber and Pardini 2008).

The aim of the current study is to extend the findings of the initial study by Flanders et al. (2009). A longitudinal design was employed to test the hypothesis that higher frequencies of father-child RTP at preschool age would continue to be associated with greater physical aggression at school age, among children whose fathers were less dominant play partners RTP. In addition, it was hypothesized that high frequency of RTP at preschool age would be associated with worse emotion regulation abilities at school age, among children with less dominant fathers. High RTP frequency was also expected to be associated with better

emotion regulation abilities among children with more dominant fathers. To test these hypotheses, physical aggression and emotion regulation were measured 5 years after the initial study, in line with the model tested in the original study by Flanders et al. (2009).

Method

Participants

In 2001 (Time 1), a community sample of 85 father-child dyads (43 boys and 42 girls) were observed during a free-play activity (Flanders et al. 2009); a follow-up study was conducted in 2006 (Time 2). Fathers were initially solicited to participate in a study of father-child play interactions with notices that were placed at the entrances of local community health centers in and around Montreal, Quebec, Canada. At Time 1, the mean age of the fathers was 33.6 years ($SD=7.9$) with a mean of 14 years of education ($SD=3.3$). The age range of the children (22–71 months) was chosen because it corresponded with the period in which parent-child RTP activities are most common (Pellegrini and Smith 1998).

Participants were contacted again 5 years later via telephone for this follow-up study. There had been no regular contacts with families after the first assessment. Secondary contacts through friends, neighbors, or extended family, which are typically used to track families in longitudinal studies, were not requested at Time 1. Nonetheless, 47 of these families could be traced and 34 accepted to participate in the time frame of our data collection, including 19 boys and 15 girls. The mean age of the fathers was 40.10 years ($SD=8.3$) with a mean of 14.8 years of education ($SD=3.0$). The mean age of the children at Time 2 was 8.4 years ($SD=1.3$). All of the testing was conducted in French and all participants were either francophone or had French as a second language.

Based on data from Time 1, the families included in the follow-up study were compared to the families lost to attrition. T-tests revealed that there were no differences in the frequency of RTP and other types of play between father and child, dominance during play, father's level of education, and father's age.

Measures

Play Frequency The frequency of parent-child play was assessed with the "Père-En-Jeux" questionnaire (Paquette et al. 2003) at Time 1 (Flanders et al. 2009). To assess the frequency of father-child RTP, fathers were asked "How often do you play fight with your child?" To assess the frequency of play in general, fathers were asked "How

often do you play with your child?" Fathers chose from the following responses "never", "sometimes", "regularly", "often", or "very often".

Father Dominance A 7-min father-child free play session was videotaped in the participants' homes. The "Play Regulation Coding Scheme" (PRCS; Flanders et al. 2009) was designed to describe the dominance relationship between child and father during play. Every 10 s during active play bouts, father-child dyads were given a "dominance" score based on the degree to which the father controlled the flow of play or held the dominant position in relation to the child during that time frame. Scores ranged from 0 to 4, where 0 = passive or submissive, 2 = shared, 4 = dominating or in charge, and 1 and 3 were midpoints between these anchors ($M=3.1$; $SD=.6$). The dyad's level of dominance was assessed every 10 s during play bouts and each dyad's overall score was the mean of the ratings through the entire play episode. Two research assistants coded the videos using the PRCS. They each coded half of the videos independently and in addition to another 20%, which they both coded for the purposes of evaluating inter-rater reliability. The inter-rater reliability of the measure was adequate (weighted kappa=.77, $p<.01$). It is important to note that dominance was assessed across a variety of play interactions, including but not restricted to RTP. Thus, dominance scores reflect a feature of the play dyad in general. We are operating from the assumption that this feature applies to the RTP interactions about which the fathers reported on the RTP frequency question. For further discussion of this issue as well as more information about the dominance measure, see Flanders et al. (2009).

Physical Aggression Physical aggression was assessed with a subscale of the National Longitudinal Study of Children and Youth (NLSCY) Behavior Questionnaire (Huijbregts et al. 2007; Tremblay et al. 2004). Fathers were asked to report on the frequency of a variety of behaviors by choosing "never or not true", "sometimes or somewhat true", "often or very true", or "don't know". The Time 1 physical aggression score used for this current study was the mean frequency of: "physically attacks people," "hits, punches, or kicks other children." (Cronbach's $\alpha=.69$). The Time 2 physical aggression score differed slightly and was the mean frequency of the following behaviors: a) "physically attacked people" and b) "hit, bit, or kicked other children" (Cronbach's $\alpha=.68$). The Time 1 and Time 2 physical aggression scores were correlated at .58 (see Table 1).

Emotion Regulation Emotion regulation was assessed with father responses to the Emotion Regulation Checklist (ERC; Shields and Cicchetti 1997). The reliability of the ERC with children between the ages of 6 years to 12 years

Table 1 Correlations among principal variables

	RTP frequency	Father dominance	Time with child	General play frequency	Physical aggression T1	Physical aggression T2
Father dominance	**−0.33	–				
Time with child	−0.08	**0.30	–			
General play frequency	0.25	0.18	0.05	–		
Physical aggression T1	**0.31	**−0.29	−0.20	−0.01	–	
Physical aggression T2	0.26	−0.03	−0.10	−0.15	*0.58	–
Emotion regulation	*−0.41	0.20	0.02	−0.24	0.02	0.05

$N=33$

* $p < .05$ (2-tailed), ** $p < .10$ (2-tailed)

has been established elsewhere (Shields and Cicchetti 1997). This checklist is a 24-item scale that is designed to measure children's emotion-regulation. The ERC is composed of both positively and negatively weighted items that are rated on a 4-point Likert scale. Fathers responded by choosing between 1 = "never," 2 = "sometimes," 3 = "often" and 4 = "almost always" for each item. The Emotional Regulation (ER) subscale is composed of items that describe situationally appropriate affective displays, empathy and emotional self-awareness. Items on this subscale include "is empathetic toward others," and "can say when s/he is feeling sad, angry or mad, fearful or afraid." The ER scale is produced by reversing all negatively weighted items and averaging across all items (Shields and Cicchetti 1997). The internal consistency of the scale in the current sample was adequate ($\alpha=.73$). The mean ER scale score was 26.5 ($SD=4.9$, $N=34$).

Socio-Demographics Basic socio-demographic characteristics of the father and child in the sample included:

- Age*: At Time 1 and Time 2, fathers were asked to indicate their age in years and the age of their children in months.
- Education*: Fathers were asked to indicate their last year of schooling completed.
- Time with child*: At Time 1, fathers were asked to indicate how much time they spent alone with the target child, in hours during the entire week.

Procedure

At Time 1, research assistants visited the participating families in the homes. In a free-play context without toys, the fathers were given the following directions: "Play the way you usually do with your child." The dyads were filmed for 7 min while playing with their child and were then asked to fill out the series of questionnaires. All

families gave their consent to participate in the experiment and were compensated \$20 for their time. Once the visit was complete, the videos were coded using "The Observer Video-Pro" (Noldus et al. 2000). (For more information on the home visits, see Flanders et al. 2009.)

At Time 2, fathers were contacted by phone and invited to participate in the follow-up. If verbal consent was obtained from the father, an appointment time was booked for research assistants (RAs) to visit the family in their homes for data collection. Upon the RAs arrival, fathers were given an additional brief information session on the purpose of the follow-up study. Informed consent and assent was obtained from the father and the child. Participants were treated in accordance with the ethical guidelines of the McGill University Policy on the Ethical Conduct of Research Involving Human Subjects (McGill University Research Ethics Board II) and the American Psychological Association's Ethical Principles and Guidelines for the Protection of Human Subjects of Research (American Psychological Association 2002). Fathers were then invited to complete a battery of questionnaires, including the ERC, while the child carried out several tasks. Children were administered a variety of tests and were also asked to complete several questionnaires. Parents were debriefed at the end of the visit and received twenty dollars (\$20) for their participation. The children received a small toy for their participation.

Results

Initial Analyses

One father completed the ERC but not the Behavior Questionnaire; therefore physical aggression data on this child is missing. Of the 85 father-child dyads observed at Time 1, 7 did not display any lasting play interactions. One of these 7 dyads was among the 34 participants in the current study.

Physically aggressive behavior is known to decrease over the course of childhood for most children (Alink et al. 2006; Bongers et al. 2004; NICHD 2004). Because there was a broad age-range in the current sample of school-aged children, it was necessary to control for age in studying physical aggression. To do so, the Time 1 and Time 2 physical aggression scores in the current study were the standardized residuals of regression analyses of age on physical aggression at each time point.

Prior to further analysis, all scales and measures were examined for normality and outliers and corrected according to recommendations from Tabachnick and Fidell (2007). It was necessary to apply square root transformations to the ER scale and to the age-corrected physical aggression scales. Two univariate outliers in the father dominance score were replaced with the next highest, non-outlying values. Otherwise, all of the measures met the assumptions for regression analyses. Table 1 presents the correlations among the principal variables for the participants of this study. All subsequent analyses were conducted with standardized scores to enable comparisons across analyses. For all significance tests, we accepted an alpha level of .05 because of the increased risk for Type-II error and because the two dependent variables of interest were unrelated.

Physical Aggression

To test the hypothesis that the frequency of father-child RTP and father dominance during play at preschool age would predict physical aggression 5 years later, a sequential multiple regression analysis was conducted with physical aggression at Time 2 as the dependent variable. We essentially tested the same model used in the initial study (Flanders et al. 2009). Step 1 included general play frequency and time spent with father. Step 2 included RTP frequency and father dominance. Step 3 included the interaction between RTP and father dominance. The model initially included sex (main effect of sex, 2-way interactions between RTP and sex and dominance and sex, and the 3-way interaction between RTP, dominance, and sex), but none of the effects involving sex were significant so sex was removed from the model.

Table 2 illustrates this model and the results ($N=32$). The only significant effect was the RTP-by-dominance interaction $\beta=-.39$, $t(31)=-2.27$, $p=.04$. This finding suggests that the relationship between RTP, dominance and physical aggression first observed in the preschool years (Flanders et al. 2009), holds through to the school years. The interaction in the first model above was decomposed using a procedure outlined by Holmbeck (2002), following the recommendations of Aiken and West (1991). The results suggest that, as father dominance decreases among the

dyads, more frequent RTP was associated with more frequent physically aggressive behavior. The slope of the regression line at -1 SD on the father dominance scale was significantly different from 0 $t(31)=2.9$, $p<.01$. The slopes of the regression lines at the mean and at $+1$ SD on the father dominance scale were not significant. The interaction effect is illustrated in Fig. 1.

Because time 1 and Time 2 physical aggression were highly correlated, it is possible that the observed effect of RTP and dominance on physical aggression at school age is due to the association of these measures concurrently at preschool age; the current result would only be capturing a stable process. To determine whether the current interaction effect is independent of the earlier finding, the same analysis was run with Time 1 age-corrected physical aggression entered as a covariate. The effect of Time 1 physical aggression was significant $\beta=.52$, $t(31)=3.28$, $p<.01$. The interaction effect was attenuated slightly from $\beta=-.39$ to $\beta=-.29$, $t(31)=-1.84$, $p=.08$. This result suggests that some of the variance in Time 2 physical aggression that is explained by the interaction is accounted for by Time 1 physical aggression, but the size of the β statistic suggests that interaction still predicts a sizable portion of Time 2 physical aggression variance even when Time 1 aggression is in the model.

Emotion Regulation

To test the hypothesis that the frequency of father-child RTP and father dominance during play at preschool age would predict emotion regulation abilities 5 years later, the same regression model as described above was used to predict emotion regulation scale score. Once again, none of the effects involving sex were significant, so they were removed from the model. Table 3 illustrates the final model and the results ($N=33$). The only significant predictor of emotion regulation was the interaction between RTP and father dominance $\beta=.39$, $t(32)=2.31$, $p=.03$. The decomposition of the interaction revealed that as father dominance decreases among the dyads, more frequent RTP was associated with lower emotion regulation scores. The slope of the regression line at -1 SD on father dominance was significantly different from 0 $t(32)=-2.89$, $p<.01$. The slopes of the regression lines at the mean and at $+1$ SD on father dominance were not significantly associated with physical aggression. This interaction effect is illustrated in Fig. 2.

Once again, the extent to which the observed interaction effect is independent of the initial association with physical aggression in the preschool years (Flanders et al. 2009) was tested. The same analysis was run with Time 1 age-corrected aggression entered as a covariate. This time, the interaction effect was strengthened slightly from $\beta=.39$ to

Table 2 Summary of sequential regression analysis for variables predicting physical aggression (N=32)

Variables	R^2	ΔR^2	B	SE B	β	p
Step 1	.03	.03				
Time with child			-.11	.20	-.10	.61
General play frequency			-.15	.19	-.14	.45
Step 2	.14	.11				
Time with child			-.12	.21	-.11	.55
General play frequency			-.28	.20	-.26	.18
RTP frequency			.40	.22	.37	.07
Dominance			.18	.22	.17	.41
Step 3	.28	.14				
Time with child			-.17	.19	-.15	.40
General play frequency			-.31	.19	-.29	.12
RTP frequency			.34	.21	.31	.11
Dominance			.07	.21	.07	.75
RTP frequency × dominance			-.38	.17	-.39	.04

$\beta = .45, t(32) = 2.70, p = .01$. Overall, the results suggest that the relationship between RTP and dominance in the preschool years and emotion regulation 5 years is mostly independent of physical aggression in the preschool years.

Discussion

The current study tested the hypothesis that the frequency of father-child RTP and the father’s dominance during play in the preschool years would still be related to children’s physically aggressive behavior and emotion regulation abilities 5 years later. The findings of the current study indicate that among father-child play dyads, in which the father was relatively less dominant, the frequency of RTP

predicted more physically aggressive behavior and poorer emotion regulation abilities 5 years later. Physical aggression was not associated with emotion regulation, probably because emotion dysregulation is one of several potential triggers of physically aggressive behavior. These associations were found while controlling for the age of the child, frequency of father-child play in general, and the overall time spent with the father. These findings are not only consistent with an initial study of preschoolers that demonstrated similar findings when these constructs were measured concurrently (Flanders et al. 2009), but also suggest a developmental process that expands beyond the preschool period into school-age.

Interestingly, the effect of RTP and dominance on physical aggression 5 years later was only slightly attenuated after controlling for aggression at Time 1. This suggests that RTP with less dominant fathers not only predicts overall level of physical aggression at school age, but it also predicts a tendency to increase the use of physical aggression, relative to peers, between preschool and school age. Although physically aggressive behaviors typically decrease with age, some children maintain a high frequency of such behaviors through childhood (Tremblay 2003, 2006, 2008). The current finding raises the possibility that father dominance during RTP is especially important for children at risk for chronic physical aggression. This suggestion could be investigated in a longitudinal study with a large sample and more frequent measures of physical aggression and RTP than were obtained with the current design.

Other studies have highlighted the importance of power dynamics during father-child play, particularly with respect to the development of peer competence. For example children who have a more “horizontal” or cooperative relationships with their fathers during play tend to be more

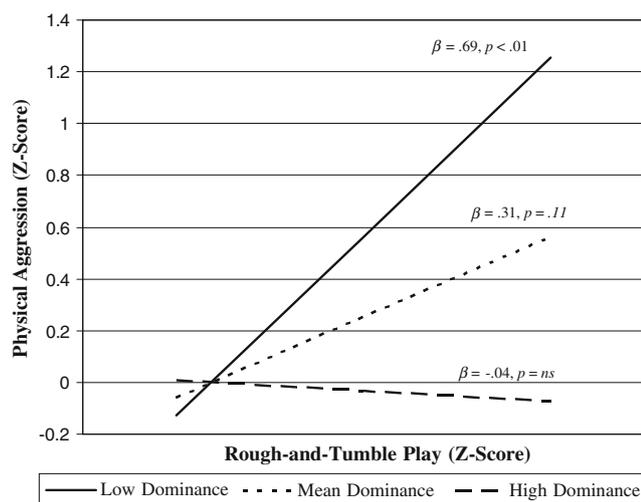


Fig. 1 Rough-and-tumble play and physical aggression by father dominance

Table 3 Summary of sequential regression analysis for variables predicting emotion regulation ($N=33$)

Variables	R^2	ΔR^2	B	SE B	β	p
Step 1	.06	.06				
Time with child			.06	.18	.06	.76
General play frequency			-.26	.19	-.24	.19
Step 2	.21	.15				
Time with child			-.04	.18	-.04	.81
General play frequency			-.19	.20	-.18	.34
RTP frequency			-.36	.20	-.34	.09
Dominance			.14	.20	.13	.50
Step 3	.34	.13				
Time with child			-.01	.17	.01	.94
General play frequency			-.16	.18	-.15	.39
RTP frequency			-.29	.19	-.27	.14
Dominance			.26	.20	.24	.20
RTP frequency \times dominance			.37	.16	.39	.03

competent with their peers (e.g., Lindsey and Mize 2000). However, this view may not apply to dominance dynamics that may operate differently in the context of RTP. It may be that the heightened arousal and affect characteristic of RTP interactions may be particularly difficult for children to regulate. If that were the case, a stronger, more authoritative presence by the father would especially import in RTP compared to other play contexts. Future studies with larger samples might examine whether dominance during RTP would be associated with greater psychosocial adjustment than dominance in other play contexts.

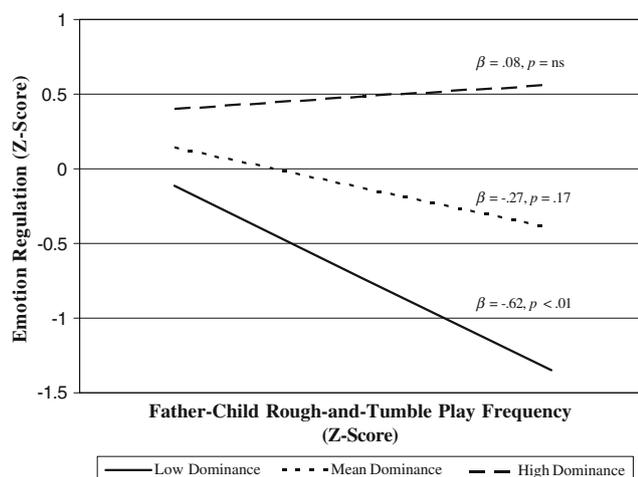
Sex was not a significant factor in this study. RTP is stereotypically known as the domain of fathers and boys. Indeed, in our sample, boys did engage in more RTP with their fathers than girls did (Flanders et al. 2009). However, the current results suggest that sex is not an essential

consideration when studying the relationship between RTP and physical aggression and emotion regulation. Though girls may engage in less RTP with their dads, the ones that do are subject to the same pattern of results as the boys.

The current study failed to show a positive association between father-child RTP at Time 1 and the two outcome measures. While consistent with the initial study (Flanders et al. 2009), these results are not consistent with the literature showing that father-child physical play is positively associated with peer competence (Barth and Parke 1993; MacDonald and Parke 1986; Parke et al. 1988) and the animal literature showing improvements in frontal lobe functioning as a function of RTP (Burgdorf et al. 2006; Panksepp et al. 2003). If those predictions are right, it may then be that qualitative aspects of father-child RTP other than dominance have a positive impact on the child's self-regulation abilities. For example, the affective climate of the father-child RTP interactions may be a better predictor of improvements in self-regulatory functioning. Positive emotions during play could strengthen bonds between father and child, which could enhance the impact of the fathers' modeling of self-control. In line with this hypothesis, research has demonstrated that popular children tend to engage in frequent physical play with their fathers and express high levels of positive feelings during these interactions (Corr et al. 1995). Future studies might investigate the extent to which affective climate moderates the relationship between RTP and behavior self-regulation over time.

Implications

According to the current results, poorly contained RTP can be associated with physically aggressive behavior concurrently and over time. It appears that the prejudice some

**Fig. 2** Rough-and-tumble play and emotion regulation by father dominance

adults have against RTP (Panksepp 1993) is somewhat justified. RTP may make children rowdy and rough, which may make them disruptive and prone to injure themselves and others. However, this study, as well as that of Flanders et al. (2009), suggests that, with respect to father-child RTP, father dominance may be a key moderator of this association. When fathers exert a minimal amount of dominance, RTP is not associated with adverse consequences concurrently and over time. This finding echoes Tannock (2008), who reports that educators recognize the value in peer RTP in early childhood, but expect that adverse outcomes could be avoided if guidelines to effectively manage these interactions were developed.

Consistent with Flanders et al. 2009, the current findings provided partial support for theoretical models of the relationship between RTP and self-regulation (Paquette 2004; Peterson and Flanders 2005). RTP is a highly stimulating activity for children, physically, emotionally, and cognitively. During these activities, children can be pushed to the edge of their self-regulatory capacities, sometimes to the point that they become over-stimulated, hyperactive, out of control, or genuinely physically aggressive. If fathers do not contain these play interactions, the children can be aroused to the point of being out-of-control or physically aggressive and, as a consequence, do not get the opportunity to develop the skills required to regulate these states. They would also lack the motivation to do so. Learning to regulate aggression and intense emotion is demanding. Children must be convinced of the necessity of learning these skills before they mobilize themselves. They experience power and dominance of an adult through using physical aggression, without challenge or consequence. Why would they not try it with their peers? Years later, it would not be surprising that these same children are not sought out as play partners because they are too rough or wild (Coie et al. 1999; Dodge et al. 2003). These limitations in social competence may be related to more serious externalizing problems further down the road (Paquette 2004).

Recommendations for Future Studies

Although results may have valuable implications, replication is necessary because of the following limitations. First, the sample in the follow-up study consisted of less than half of the sample from the original observational study. Five years after the original study, a large number of participants were unreachable and others refused to participate. This was largely due to the fact that the initial study was not designed to be longitudinal. Consequently, key information that facilitates following families over time was not obtained. Nonetheless, there were no significant differences between the participants who participated in the follow-up

compared to those that did not. Furthermore, despite the small sample size, reduced power, and risk for type-II error, the model tested here significantly predicted physically aggressive behavior and emotion regulation scores suggesting the effect is relatively robust. A larger sample would provide greater statistical power to detect subtler effects of RTP. For example, associations between RTP and physical aggression and between RTP and emotion regulation may emerge in dyads with moderately dominant fathers, in addition to the associations reported in low dominant fathers.

A second limitation is that dominance was observed during a variety of father-child play types, not just RTP. The study was designed this way with ecological validity in mind; it seemed more natural to have participants to play the way they normally do, rather than request specific types of play. This design limits the extent to which conclusions can be drawn about RTP specifically, compared to other types of play. However, the model tested here includes effects related to the frequency of RTP while controlling for the frequency of play in general, which should mitigate concerns about the specificity of RTP to some extent.

Conclusion

Rough-and-tumble play is a dynamic, enjoyable and common activity in children and widely observed in non-human animals. Several authors have proposed that father-child RTP is related to the development of self-regulation in children (Paquette 2004; Peterson and Flanders 2005), although little empirical work has been done to test this theory directly. The current study was a 5-year follow-up to an initial study demonstrating that RTP frequency was associated concurrently with physically aggressive behavior in the preschool years among children whose fathers were less dominant during play (Flanders et al. 2009). The follow-up showed the same relationship with physical aggression measured 5 years later. The model also predicted worse emotion regulation abilities 5 years later, independently from the effect on physical aggression. These findings suggest that RTP can indeed be associated with behavior problems, but only when fathers are unable to maintain an authoritative position in the play interactions. Most researchers and parents will acknowledge that play is an important part of the father-child relationship. Thus, it is important to develop a greater understanding of the potential gain and harm these activities may bring to a child's development.

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