# VIOLENCE AND TOUCH DEPRIVATION IN ADOLESCENTS

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ABSTRACT

The increasing incidence of violence among children and adolescents highlights the importance of identifying at-risk profiles as well as assessing interventions for preventing violence. Empirical research has suggested behavioral, central nervous system, and neurotransmitter/neurohormone dysregulation in violent individuals, including (1) an underaroused central nervous system characterized by right frontal electroencephalogram (EEG) hypoactivation, and (2) a neurotransmitter/neurohormone profile of lower norepinephrine, serotonin, and cortisol, and elevated dopamine and testosterone. The literature also suggests a disproportionate incidence of physical abuse and neglect or the lack of positive physical contact in violent individuals. In the studies we have conducted to date, there has been a relatively high incidence of anger and aggression in high school samples, even those that were relatively advantaged, as well as high levels of depression (one standard deviation above the mean), suggesting significant disturbance in these youth. Adolescents with these profiles also had less optimal relationships with their families, used illicit drugs more frequently, had inferior academic performance, and had higher depression scores. In our cross-cultural comparisons, preschoolers and adolescents were less physically affectionate and more aggressive in the United States versus France. Further, the U.S. youth received less physical affection as preschoolers, and as adolescents they engaged in more self-stimulating behaviors, perhaps to compensate for receiving less physical affection from their parents and peers. This supports the notion that less physical affection (or more physical neglect) can contribute to greater aggression. Massage therapy has been effective with violent adolescents, perhaps because the physical stimulation reduced their dopamine levels and increased their serotonin levels. Their aggressive behavior decreased and their empathetic behavior increased. These preliminary data need to be replicated in a larger sample with a more comprehensive set of measures in the context of identifying a diagnostic profile.

## VIOLENCE AND TOUCH DEPRIVATION

### *Incidence of Violence*

Approximately one-third to one-half of clinic referrals among children and adolescents are for aggression and conduct disorder problems (Vitiello & Stoff, 1997). The homicide rate for adolescents in the U.S.

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is the highest of the industrialized nations (roughly 20 times higher), and in many community studies, the rates of adolescent fighting and weapon carrying have increased significantly (Orpinas et al., 1995; Sosin et al., 1995).

*Early Neglect and Abuse as a Risk Factor*

Research has identified a number of risk factors for violence in youth. One of the most commonly cited risk factors is early neglect and abuse. In many studies, aggression and antisocial behavior problems have been found in neglected or abused children and adolescents. For example, Raine et al. (1994) reported that maternal rejection at age one predicted violent crime at age eighteen. Other researchers reported that physical aggression occurred more often in children who had been physically abused (Scarpa, 1998; Scerbo & Kolko, 1995). In a study by Dodge et al. (1990), harmed or abused children had 23% higher aggression ratings by their teachers, 100% higher ratings by their peers, and 30% higher ratings by observers. Further, Widom (1989) found that adolescents who had been abused or neglected during childhood were 42% more likely to have a criminal record as an adult.

The critical need for physical affection is highlighted by a large study on 49 cultures (Prescott, 1990). In that study, the cultures that exhibited minimal physical affection toward their young children had significantly higher rates of adult violence, and, vice versa, those cultures that showed significant amounts of physical affection toward their young children had virtually no adult violence. Some suggest that the absence of physical affection or the presence of physical abuse affects the child's physiological reactivity either through the emotional trauma or through a more direct insult to the brain, and that this acquired overreactivity mediates later aggressive tendencies (Dodge et al., 1990). Others suggest that the early experience of physical neglect or physical abuse heightens sensory thresholds, such as the pain threshold, leading to underresponsivity to stimulation and hence the need for arousal-seeking behavior (Orbach, 1999).

Negative emotional affect, including depression and anxiety, has also been noted to predispose adolescents to impulsive, antisocial or aggressive behavior via a similar mechanism (Scarpa & Raine, 1997). Anxiety and depression are markedly higher in adolescents with conduct disorder (Kovacs, 1981) and, in a longitudinal study, children with comorbid conduct and anxiety disorder showed significant increases in physical aggression over a 4-year period (Lahey & McBurnett, 1992).

*EEG and Neurotransmitter / Neurohormone Profiles*

Several studies have revealed electroencephalogram (EEG) abnormalities in violent adolescents (Scarpa & Raine, 1997), which are thought to reflect general underarousal or cortical immaturity. The abnormalities have included right hemisphere dominance and excessively slow frequency EEG theta activity (Raine et al., 1990a). In the Raine et al. (1990b) sample of 15-year-old adolescents, evoked potentials including a greater N1 amplitude and faster P300 latency to a warning signal correctly classified 74% of those adolescents who became criminals at age 24. The authors suggested that individuals with chronically low levels of arousal (possibly caused by excessive filtering of stimuli) would seek out risky situations to enhance their arousal level.

In separate studies, aggressive/violent individuals have been noted to have elevated dopamine, low norepinephrine, and low serotonin levels. Elevated dopamine coupled with low levels of norepinephrine and serotonin is thought to lead to impulsive, aggressive behavior. Most studies have targeted serotonin (5-HIAA) as the primary neurotransmitter imbalance and the relationship between low levels of 5-HIAA and aggression (see Stoff et al., 1997, for a review). Their review includes both positron emission tomography (PET) and magnetic resonance imaging (MRI) studies showing lower reuptake of 5-HIAA in the prefrontal cortex. Several primate studies have also highlighted the serotonin/aggression relationship (Higley et al., 1992; Mehlman et al., 1995; Suomi, 1999). In addition, low levels of 5-HIAA have been correlated with aggression as reported by teachers; low serotonin has also been noted in children who torture animals, and children who are unusually hostile to their mothers (Halperin et al., 1997). Further, in some studies an interaction has been noted between serotonin and testosterone (Bernhardt et al., 1997). In a review of the literature, Coccaro et al. (1989) proposed that reduced serotonin activity reduced the activity of the neuronal processes that inhibit aggression. They described the resulting state as hyperresponsivity to aversive stimuli. In a rat study examining the combined influences of testosterone and serotonin (Bonsan et al., 1994), a serotonin agonist reversed the influence of increased testosterone.

Data that further support the interaction of serotonin and testosterone with aggression are found in studies in which tryptophan decreased predatory aggression (serotonin being derived from tryptophan). Higher levels of 5-HIAA in the hypothalamus and amygdala were associated with decreased aggression. Testosterone in the amygdala was associated with aggressiveness. Both the hypothalamus and amygdala

have many receptor sites for testosterone; for example, implants of testosterone in the hypothalamus have been noted to restore aggressive behavior in castrated rats (Christie & Barfield, 1972).

Testosterone has also been shown to interact with cortisol, albeit not consistently. Henry (1992) found that elevated cortisol was accompanied by lower testosterone. Others have reported no relationship between cortisol and testosterone (Scerbo & Kolko, 1994). Studies on cortisol alone have also been mixed, with some reporting reduced levels in adolescents with conduct problems (Lahey & McBurnett, 1992; Susman et al., 1991) and others noting increased levels of cortisol in conduct disorder children (McBurnett et al., 1991).

*Interventions*

Behavioral interventions have focused primarily on empathy training (e.g., the Feshbach model) and discipline modeling (for example, the Patterson and Reid model and the Carolyn Webster-Stratton teacher model). In addition, pharmaceutical treatments have been tried. Recent studies suggest that some children (proactive aggressive) are more likely to respond to behavioral therapy, while others (reactive aggressive) are more likely to respond to pharmaceutical and psychosocial interventions (Vitiello & Stoff, 1997). Antipsychotics, such as haloperidol, and mood modulators, such as lithium and carbamazepine, have been successful in aggressive children (Campbell et al., 1995; Kafantaris et al., 1992). Because of the serotonergic dysfunction reported in aggression, selective serotonin reuptake inhibitors and other serotonin-enhancing drugs, such as trazodone and buspirone, have been used (reviewed by Vitiello & Stoff, 1995).

Because of the lack of effectiveness of any single behavioral or cognitive treatment for aggression, and the unpleasant side effects of psychotropic drugs, complementary therapies are currently being investigated. Studies on relaxation training (Dangel et al., 1989; McPhail & Chamove, 1989), for example, have shown it to be effective in diminishing aggressive behavior. Biofeedback has also been effective in short-term behavior improvement for children with conduct problems (Lubar et al., 1995). Holding therapy, which involves the therapist holding the child's head in his or her lap and the parent holding the child's lower limbs, has been reported to be effective, although these claims are based largely on anecdotal data (Levy & Orlans, 2000).

*A Model of Violence and Intimacy*

In a model we have developed based on our research, violent children/adolescents come to experience these problems in part because they are lacking verbal and physical intimacy with peers and parents

or other adults. They also experience a biochemical/physiological imbalance that may lead to underresponsivity to stimulation and hence the need for arousal-seeking behavior, as has been noted by others (Dodge et al., 1990; Orbach, 1999). Interactions very early in life that are physically neglectful/abusive may be the cause. Programs that are physically interactive may help reduce physical/verbal interaction deprivation in these adolescents. In many intervention programs, verbal intimacy is provided by psychotherapy. Rarely is the verbal therapy complemented by a positive physical contact experience. Thus, we conducted a massage therapy intervention: the massage therapy reduced biochemical/physiological imbalances in aggressive adolescents (Diego et al., 2002) and in adolescents with conduct disorder (Field et al., 1992). Having reduced the verbal/physical stimulation deprivation and the biochemical/physiological imbalance, these adolescents would be expected to engage in less stimulus-seeking, risk-taking, and angry/aggressive/violent behavior. Studies we conducted that led to this model and tentatively documented what we consider the origins of violent behavior, as well as potential interventions, are briefly reviewed in the remainder of this paper.

*Angry, Risk-Taking Adolescents Lack Verbal and Physical Intimacy Experiences*

In a study on risk-taking (Gonzalez et al., 1994), a questionnaire comprised of several self-report scales, including two standardized scales and several others we had developed (Field & Yando, 1991), was administered to 440 adolescents (attending a public school) to assess differences between high and low danger risk-takers on relationship and personality variables. Danger risk-takers reported less intimacy with their mothers and greater drug use than their non-risk-taking peers.

Similarly, in another study, adolescents' intimacy with parents and friends was noted to be a protective factor (Field et al., 1995). In that study, adolescents' perceived levels of intimacy with their mother, father, and close friend were examined as a function of demographic, family, school, and psychological variables. Students who had greater intimacy with their parents had greater interest in school, higher self-esteem, lower depression, and lower risk-taking scores.

We then added items to the above questionnaire to tap variables related to anger in a sample of 89 high school seniors attending a private high school (Silver, Field, et al., 2000). One yes-no item stated: "Sometimes I get so angry that I worry I will become violent." In this middle to upper socioeconomic status sample, 58 students responded no and 31 responded yes. Splitting the groups by yes-no responses, the

anger group (versus the nonanger group) had: (1) less intimacy with their parents, (2) more frequent use of marijuana and cocaine, (3) a lower grade point average, and (4) higher depression scores.

*Verbal and Physical Intimacy May Be Lacking Early in Life*

In an attempt to investigate whether verbal and physical intimacy was lacking early in life in aggressive/violent children, we studied young children with conduct disorder and their mothers (Field et al., 1987). The children were observed in free play and puzzle completion tasks both alone and with their mothers. The mothers of conduct disorder children reported more self-depression and less nurturant child-rearing practices. The conduct disorder children were more hyperactive and less interactive during the play sessions, and their mothers were less interactive and more disapproving than the other mothers.

In a study on social anxiety and aggression in behaviorally disordered children (Gonzalez, Field, et al., 1996), 39 boys (mean age = 10 years) attending classes for behaviorally disturbed children were given questionnaires on trait anxiety, social anxiety, empathy, depression and self-esteem, and the teachers rated them on aggression. It was hypothesized that anxiety and empathy attenuate aggression. Contrary to our hypothesis, anxiety and empathy scores were not correlated with aggression. However, the children's depression scores were high.

*The Physical Contact Deprivation/Aggression Relationship May Be More Pronounced in the American Culture*

As already described, a large study on 49 cultures documented a strong relationship between less physical affection toward children and later aggression/violence (Prescott, 1990). We elected to compare France and the U.S. on physical affection toward children because Jourard (1966) had documented more physical contact in the French versus the American culture.

In our first cross-cultural study, preschoolers in America were touched less and were more aggressive than preschoolers in France (Field, 1999a). In that study, 40 French and American preschool children were observed on playgrounds with their parents and peers. The American parents watched and touched their children less than did the French parents. The American children played with, talked with, and touched their parents less and were more aggressive toward their parents. During peer interactions, the American children touched their peers less, grabbed their peers' toys more, showed more aggression toward their peers, and showed more fussing.

In a similar study, 40 adolescents were observed at McDonald's restaurants in Paris and in Miami to assess the amount of touching and aggression that occurred during their peer interactions (Field, 1999b). The American adolescents touched each other less and were more aggressive toward their peers compared with the French adolescents. The American adolescents (versus the French adolescents) spent less time touching (leaning against, stroking, kissing, and hugging) their peers. Instead, they showed more self-touching and more aggressive verbal and physical behavior.

*Physical Stimulation (Massage Therapy) May Help Reduce Physical Contact Deprivation*

In a series of studies, we provided more physical contact for violent and conduct disorder adolescents by giving them massage therapy. In the first study (Field et al., 1992), a 30-minute back massage was given daily for a 5-day period to 52 hospitalized conduct disorder adolescents. Compared with a control group who viewed relaxing videotapes, the massaged adolescents were less depressed and anxious, had lower saliva cortisol levels after the massage, and their nighttime sleep increased over this period. In addition, the unit nurses rated them as being less aggressive and more cooperative by the last day of the study.

In the second study (Diego et al., 2002), 20 violent children and adolescents (mean age = 11.4 years) were randomly assigned to a massage therapy group or a relaxation therapy group to receive 20-minute therapy sessions twice a week for 5 weeks. The massaged adolescents had lower anxiety and cortisol levels and improved mood after the first and last sessions. By the end of the study, the massaged adolescents showed more empathy and were rated as being less aggressive toward objects and less aggressive in general by their parents. The massage therapy group also showed lower dopamine levels by the end of the treatment period. The relaxation therapy group showed no such improvement.

*A Potential Model*

*Behavioral activation/inhibition systems.* Behavior, EEG activity, biochemical activity (neurotransmitter/neurohormone activity) and psychiatric disorders can be organized along the behavioral activation system (BAS)/behavioral inhibition system (BIS) described by Gray (1982) and later by Quay (1988). The balance between these regulatory systems (i.e., the BAS and the BIS), rather than the absolute strength of the systems, is thought to determine normal behavior (Rogeness et al., 1992). Dysfunctional behavior is believed to occur when these regulatory systems are out of balance. The behavioral activation system is thought to be integrated in the mesolimbic and dopaminergic

systems (Depue & Spoont, 1986) and is activated primarily by reward stimuli or escape/avoidance of aversive stimuli (Rogeness et al., 1992). In contrast, the behavioral inhibition system appears to be a septohippocampal system, the regulation being noradrenergic with additional regulation from the serotonergic system (Rogeness et al., 1992). The behavioral inhibition system is responsive to conditions of nonreward, punishment, and uncertainty. In our adaptation of the Behavioral Inhibition and Behavioral Approach System Questionnaire (Carver & White, 1994), we have been able to tap these behavior characteristics in children (Field, 2000).

In studies we have conducted on preschool-age children, we have noted weak approach behavior in depressed children and weak inhibition in conduct disorder children. For example, in a study on depressed and conduct disorder children (Field et al., 1987), we observed the children's free play and puzzle completion with their mothers and found that the conduct disorder children were more active motorically and less interactive during play sessions, and their mothers were less interactive and more disapproving than the other mothers. In a study on children in a psychiatric unit, the children and their mothers were observed during play interactions (Lundy et al., 1997). These dyads behaved differently as a function of whether the children were diagnosed as having internalizing or externalizing disorders. Maternal depression was also found to interact with their children's diagnoses and behavior ratings. In another study (Escalona et al., 2001), we noted that externalizing preschool children exhibited aggression more often. All these studies highlight the difficult interactions of young children with externalizing/internalizing problems and conduct disorder/depression.

*EEG activation.* The behavioral activation/inhibition system (and balance) is also reflected in EEG activation. Studies in our lab (Diego et al., 2001) and in other labs (Sutton & Davidson, 1997) have documented significant relationships between BIS/BAS scores and EEG patterns. EEG activation has frequently been described in the context of approach/withdrawal behavior, with relative left frontal EEG activation being associated with approach behavior and relative right frontal EEG activation being associated with withdrawal behavior (Davidson & Fox, 1988; Fox, 1994). We have documented, as have others (Dawson et al., 1992), left frontal EEG hypoactivation in several samples of depressed mothers (Field, 1998a) and the very early emergence of left frontal EEG hypoactivation in the infants of depressed mothers at 3 months of age (Field et al., 1998), 1 month (Jones et al., 1998), and even as early as 1 week (Jones et al., 1998). We have also documented the stability of these patterns from birth to 3 months (Jones et al., 1998) and from 3 months to 3 years (Jones et al., 1997).

*Neurotransmitter/neurohormone systems.* The norepinephrine, dopamine, and serotonin systems seem to be most influential on behavior and behavior disorders (Rogeness et al., 1992). Dopamine appears to be the neurotransmitter that is most involved in active behavior patterns such as aggressive behavior, while norepinephrine and serotonin appear to regulate or inhibit dopamine-dependent behavior. Each of these biogenic amines transmits to widespread areas of the brain from only a few centers (Rogeness et al., 1992), functioning to keep the different brain systems in proper tune and balanced. Behavior disorders occur when these regulatory systems are out of balance. Some have hypothesized that excessive dopaminergic activity may make an individual more reward-driven, and without the influences of the noradrenergic and serotonergic systems, that drive may develop into impulsive, conduct disorder behavior (Rogeness et al., 1992). In contrast, an overactive noradrenergic system without activation of the dopaminergic system may lead to depression.

We have documented the very early emergence of these profiles in infants of depressed mothers (Field et al., 2001; Lundy et al., 1999). As early as birth, infants of mothers who were depressed during pregnancy showed the same neurotransmitter profile as their mothers' pregnancy neurotransmitter profile, including elevated norepinephrine and cortisol and low levels of dopamine and serotonin.

Rogeness, Javors, and Pliszka (1992) have suggested the following neurotransmitter profiles for normal adolescents, those with depression, and those with conduct disorder/aggression: (1) normal behavior is characterized by elevated levels of norepinephrine, dopamine, and serotonin, which appear to be relatively balanced; (2) the depressed individual is thought to have elevated norepinephrine and low levels of dopamine; and (3) conduct disorder/aggression is characterized by low levels of norepinephrine and elevated levels of dopamine. Low levels of serotonin and elevated levels of cortisol are common to these adolescent psychiatric disorders.

*Model of the Behavior/EEG/Neurotransmitter Profiles Combined*

We have integrated the behavioral activation/inhibition system profiles of Gray (1982), the neurotransmitter profiles hypothesized by Rogeness et al. (1992), and the EEG quadrants suggested by Fox (1994) and Davidson (1998) in a model we are proposing to study. In the model: (1) reactive aggression features more behavior inhibition (higher BIS score), greater activation of right frontal EEG, and higher norepinephrine levels than proactive aggression; (2) depression is characterized by a weak behavior approach pattern (low BAS score), hypoactivation of left frontal EEG, low norepinephrine and elevated

dopamine; and (3) proactive aggression is characterized by a weak behavior inhibition pattern (low BIS score), hypoactivation of right frontal EEG, low norepinephrine and elevated dopamine. Little research has been conducted on the EEG profiles aside from that of normal and depressed individuals. Relative left frontal hypoactivation has been documented (by our laboratory and others) in depressed adults (Field et al., 1995). The model we are assessing would characterize the four groups of children as follows: depression (abused/nonviolent), proactive aggression (abused/violent), reactive aggression (nonabused/violent), and normal (nonabused/nonviolent). The only profile we have documented is that associated with depression.

*Reactive aggression (nonabused / violent).* We are proposing this profile for the reactive aggressive children who are aggressive because their dopamine levels are high but less aggressive than proactive aggressive children because they have the inhibitory effects of right frontal EEG activation (notably associated with withdrawal) (Fox, 1994) and higher levels of norepinephrine (known to have regulatory effects on dopamine) (Rogeness et al., 1992).

*Proactive aggression (abused / violent).* Proactive aggression has been hypothesized (like conduct disorder) to feature relatively high dopaminergic function relative to low norepinephrine and serotonin levels (Rogeness et al., 1992). Proactive aggressive symptoms are thought to be related more to the low level of serotonin (which functions to modulate dopamine) than to the high dopamine level per se (particularly in the subtype called conduct disorder undersocialized aggression). In separate studies, low norepinephrine and serotonin levels have been substantiated (Rogeness et al., 1986, 1988, 1990) in adolescents with disruptive behavior disorders (Kruesi et al., 1990).

### *Massage Therapy Effects Model*

In other studies we have conducted, serotonin levels have increased (Field, Grizzle, et al., 1996; Hernandez-Reif et al., 1998, 2001) and frontal EEG activation patterns have normalized (Field, Ironson, et al., 1996; Jones & Field, 1999) following massage therapy. Based on our data from other massage therapy studies, we would expect: (1) all those receiving massage therapy would experience increased left frontal EEG activation and serotonin and decreased cortisol, and the increased serotonin would decrease testosterone and aggression; (2) the reactive aggressive would experience decreased behavior inhibition and norepinephrine; and (3) the proactive aggressive would experience increased behavior inhibition.

### *Conclusion*

Children and adolescents who are diagnosed as conduct disordered and violent have less physically intimate relationships. This may be a

factor in the development of their disorder. Physical contact treatments like massage therapy may help reduce their aggressive behavior and normalize their EEG and biochemical profiles. Further research is needed to identify the profiles (behavioral, physiological, and biochemical, for example) of proactive and reactive aggressive adolescents so that they may be targeted for earlier interventions.

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