

A Study of the Neurobiological Mechanisms of Non-suicidal Self-injurious Behaviour

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Abstract: Non-suicidal self-injury (NSSI) often occurs in adolescence and early adulthood, accompanied by an increase in the incidence and development of related diseases, making it a significant risk factor for suicide. NSSI behavior among adolescents has become a serious public health issue, threatening their physical and mental development. This article explores the identification methods, biological causes, and emotional causes of NSSI behavior and provides current applicable treatment interventions. By elaborating on the harm of NSSI behavior to adolescents, identification methods, and intervention strategies are proposed to provide a theoretical basis for monitoring and protecting adolescent health in order to improve NSSI behavior among adolescents.

Keywords: Non-suicidal self-injury, the neurobiological mechanisms, adolescent, Treatment.

1. Introduction

Non-suicidal self-injury (NSSI) refers to behaviors that intentionally and directly harm one's own body without the intention of committing suicide[1]. These behaviors include cutting, burning, and biting oneself, among other forms. NSSI not only causes physical harm but also reflects emotional distress and psychological pressure. Understanding the causes and coping strategies of NSSI is crucial for protecting the physical and mental health of children and adolescents[2]. NSSI involves the interplay of biological, psychological, and social factors[3]. This article explores the external identification methods, biological mechanisms, and emotional regulation mechanisms of NSSI among adolescents and proposes corresponding treatment interventions to preempt potential suicidal behaviors, mitigating their impact on normal growth and self-perception.

2. Identification of Non-Suicidal Self-Injury

2.1. Physical Scars

NSSI involves intentional and repeated self-inflicted injuries without suicidal intent, such as cutting the skin, burning, and hitting oneself[4]. Unexplained cuts, burns, or bite marks, especially in concealed areas (like the inner arms and ankles), may indicate self-injury[2]. Such self-injury behavior may occur repeatedly over a period of time and have a certain impact on the normal life of teenagers. They may also wear long sleeves, pants, and other ways to demonstrate the wound. When they are asked and touched, they may also exhibit avoidance and hiding behavior. In life, parents and

schools should improve the vigilance of teenagers in this aspect of behavior and discover the abnormal state of children in time. Parents and teachers can identify NSSI behavior and respond timely by observing these marks.

2.2. Emotional Changes

Adolescents undergo significant physiological, cognitive, and emotional changes and are relatively immature psychologically[4], making them susceptible to emotional fluctuations. They are likely to be irritable, depressed, and difficult to control their emotional impulses, often because of the temporary extreme emotional fluctuations and emotions that dominate the behavior, and make impulsive or even contrary to the environmental discipline, which is likely to affect the life and life experience of teenagers. It can lead to conflicts with parents, violation of school rules, and even serious social problems such as juvenile delinquency. Non-suicidal self-injury behavior is likely to become an incentive or sign of adolescent emotional change, and when this behavior appears in teenagers, it should be vigilant to avoid causing more derivative problems. NSSI behavior can lead to psychological disorders[5]. Observing whether adolescents exhibit symptoms of depression, irritability, or anxiety helps in identifying NSSI behavior.

2.3. Interpersonal Relationship Issues

Research shows that NSSI behavior is related to poor parental and peer relationships[6]. For young people, before entering the society to get a job, school and family occupy the vast majority of life, and when there are serious interpersonal problems, the impact on young people will be huge. Disharmony with classmates, difficulty in getting along with teachers, or difficulty in communicating with parents, these small problems may be amplified in the life of two points and one line, resulting in more serious emotional problems for adolescents, and further increasing the probability of non-suicidal suicidal behaviors. Adolescents facing intimate relationship problems might be at risk of NSSI behavior.

3. Neurobiological Mechanisms

3.1. Hypothalamic-Pituitary-Adrenal Axis

NSSI behavior is associated with the activation and regulation of complex psychological and biological systems and stress responses[7]. Under acute stress conditions, threat signals are transmitted through the nervous system and other physiological systems, including the hormone cascade of the hypothalamic-pituitary-adrenal (HPA) axis, leading to increased cortisol levels in systemic circulation[8]. Research by Klimes-Dougan et al. found that adolescents with NSSI exhibit different cortisol levels in response to stress[9]. By comparing the two groups of cortisol hormones, we can discover the potential relationship between this index and non-suicidal self-injury behaviors of adolescents, and further research can be conducted on preventive measures in this field.

3.2. Symptoms of Emotional Regulation Difficulties

One current study found that reduced prefrontal cortex and cingulate cortex activation in patients with nonsuicidal self-injury was associated with crossed emotional regulation and increased impulsivity [10]. It has also been shown that there is a significant association between emotional dysregulation and a higher lifetime prevalence of non-suicidal self-injury and the use of non-suicidal self-injurious behavior as a maladaptive emotion regulation strategy [11]. In a study by Peng Liu and Enle Pei et al., it was found that the core purpose of NSSI in adolescents is to alleviate negative emotions, with the main reason for most of these adolescents to develop the behavior being to release unbearable

stress [12]. Meanwhile, the connections between the left dorsolateral prefrontal cortex and other brain regions such as the dorsomedial prefrontal cortex, ventral prefrontal cortex, foveal prefrontal cortex, anterior cingulate cortex, and the amygdala play an important role in the process of emotion regulation [13]. This shows the impact that the stimulation of this part of the brain area causes on the individual's emotion regulation, which indirectly leads to NSSI behavior in the adolescent population.

4. Treatment of Non-Suicidal Self-Injury

4.1. Psychological Therapy

Cognitive Behavioral Therapy (CBT) is widely used in treating NSSI. Studies show that internet-based Cognitive Behavioral Therapy (ICBT) improves NSSI, suicidal ideation, and problem-solving abilities[14]. Family-Based Therapy (FBT), group counseling, and Dialectical Behavior Therapy (DBT) are also commonly used methods[15]. However, long-term psychological treatment is often expensive, and for Chinese adolescents, families who can afford psychological treatment often give up the root cause of adolescent non-self-injury-suicide treatment because of lack of attention or time. It is feared that psychotherapy has not yet become the first choice in the popular psyche for the prevention or treatment of mental illness in adolescents, and to improve on this requires not only the efforts of social opinion, but also a more approachable and more acceptable to patients and their families in the field of treatment.

4.2. Pharmacotherapy

Currently, the FDA has not approved any pharmacotherapy specifically for NSSI[16]. However, studies suggest that N-acetylcysteine (NAC) might be effective for NSSI. Research by Cullen indicates that NAC treatment normalizes NSSI behavior in adolescents[17]. As a treatment that is more easily integrated into life, drug treatment is more easily accepted at the psychological level for adolescents and their guardians. The research on drugs for the prevention of non-suicidal NSSI among adolescents is bound to be more in-depth, so as to help the early intervention of depression causes of NSSI among adolescents in a wider range.

4.3. Physical Therapy

Repetitive Transcranial Magnetic Stimulation (rTMS) is a non-invasive and painless neuromodulation tool that treats various psychiatric and neurological disorders by altering neuronal excitability[18]. Although currently approved only for depression treatment[19], some studies have employed rTMS for treating NSSI[20]. However, it is worth mentioning that due to the influence of novels, movies and social news, physical therapy always gives people a bad impression. Many people will associate electric shock therapy with severe mental illness or even torture to extract confessions, so that patients are often the most likely to resist this kind of treatment, thus affecting the start or progress of treatment. Even if this type of therapy has a practical effect.

5. Conclusion

NSSI behavior is a significant issue in adolescent development, caused by biological factors and emotional regulation issues, manifesting as physical scars, emotional changes, and interpersonal relationship changes. It can be improved and cured through psychological, pharmacological, and physical therapies. Timely identification and intervention of NSSI behavior are crucial for adolescents' physical and mental health and social relationships. NSSI behavior may also be a precursor to depression, bipolar disorder, and suicidal behavior. Future research should summarize experiences, delve into its biological mechanisms, identify adolescents in distress, and implement

targeted treatments. Adolescent psychological problems have always been an important social problem, and it is never only a family that needs to face this problem, and the problem that needs to face is never only a non-suicidal self-injury. It is always an important way to find solutions to social problems from the root, especially in the development of adolescents. Early adverse environmental encounters are likely to bury the seeds of tragedy; only early detection, early intervention, early treatment, the psychological problems of adolescents from the beginning to adjust, and external auxiliary treatment can try to ensure the health of the adolescent growth environment. In this regard, it is not only necessary for the joint research of psychologists from all walks of life but also for the exploration of biological causes and cures of psychological disorders, but also for the cooperation of schools, families, networks, and all walks of life in order to escort the growth of our young people.

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