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The influence of anger expression on wound healing ☆

Jean-Philippe Gouin [a,b,*], Janice K. Kiecolt-Glaser [a,b,c], William B. Malarkey [b,c,d], Ronald Glaser [b,e]

[a] Department of Psychology, The Ohio State University, USA
[b] Institute for Behavioral Medicine Research, Ohio State University College of Medicine, USA
[c] Department of Psychiatry, Ohio State University College of Medicine, USA
[d] Department of Internal Medicine, Ohio State University College of Medicine, USA
[e] Department of Molecular Virology, Immunology, and Medical Genetics, Ohio State University College of Medicine, USA

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Abstract

Certain patterns of anger expression have been associated with maladaptive alterations in cortisol secretion, immune functioning, and surgical recovery. We hypothesized that outward and inward anger expression and lack of anger control would be associated with delayed wound healing. A sample of 98 community-dwelling participants received standardized blister wounds on their non-dominant forearm. After blistering, the wounds were monitored daily for 8 days to assess speed of repair. Logistic regression was used to distinguish fast and slow healers based on their anger expression pattern. Individuals exhibiting lower levels of anger control were more likely to be categorized as slow healers. The anger control variable predicted wound repair over and above differences in hostility, negative affectivity, social support, and health behaviors. Furthermore, participants with lower levels of anger control exhibited higher cortisol reactivity during the blistering procedure. This enhanced cortisol secretion was in turn related to longer time to heal. These findings suggest that the ability to regulate the expression of one's anger has a clinically relevant impact on wound healing.

Keywords: Anger expression; Anger control; Wound healing; Cortisol; Hostility; Negative affect; Social support; Health behaviors; Psychoneuroimmunology

1. Introduction

1.1. Stress and wound healing

Both brief naturalistic stressors and chronic stress are associated with delayed wound healing. For example, women who were caring for a spouse or parent diagnosed with dementia took on average 24% longer to heal a standardized wound compared to demographically indistinguishable control participants (Kiecolt-Glaser et al., 1995). Milder transitory stressors can also influence wound repair. Dental students took 40% longer to heal a wound placed on the hard palate before an examination compared to a wound placed at the end of their summer vacation (Marucha et al., 1998).

Self-reported symptoms of psychological distress appear to affect speed of healing as well. Healthy young men who were classified as slow healers, i.e. who were in the half of the sample that took longer to heal, reported significantly more perceived stress than fast healers (Ebrecht et al., 2004). Similarly, patients with leg ulcers who exhibited higher levels of anxiety and depression were more likely to be categorized as slow healers, compared to patients

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* Corresponding author. Address: Institute for Behavioral Medicine Research, Ohio State University College of Medicine, 193 McCampbell Hall, 1581 Dodd Drive, Columbus, OH 43210, USA. Fax: +1 614 292 0038.
E-mail address: gouin.1@osu.edu (J.-P. Gouin).

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reporting lower psychological distress (Cole-King and Harding, 2001).

Even a very commonplace stressor, a discussion of marital problems, can delay wound healing. Couples took one day longer to heal blister wounds placed following discussion of a marital disagreement compared to wounds placed before a supportive interaction. Importantly, the couples who exhibited high levels of hostile behaviors across both visits took two more days to heal on average compared to less hostile couples. Following the marital interaction, hostile couples also reported higher levels of negative mood for the remainder of the day compared to couples displaying fewer negative behaviors; this increased negative mood occurred despite an absence of affective group difference at baseline, suggesting a lingering negative impact of the marital disagreement (Kiecolt-Glaser et al., 2005).

1.2. Anger and wound healing

Anger is among the emotions elicited by conflicted interaction that might contribute to slower wound repair. This affective state includes feelings that range in intensity from irritation or annoyance to intense fury and rage (Spielberger et al., 1983). Trait anger represents the propensity to frequently experience feelings of anger (Spielberger et al., 1983), while hostility refers to a negative attitude toward others, consisting of enmity, denigration, and ill will (Smith, 1994). A hostile attitude appears to lead to more frequent episodes of anger (Eckhardt et al., 2004). The manner in which the anger feelings are expressed appears to influence the physiological and psychological consequences of this negative emotion (Deffenbacher et al., 1996). The tendency to express one's anger outwardly toward individuals or objects through physically or verbally aggressive behaviors has been termed "anger out", while "anger control" refers to the extent that an individual attempts to control the outward expression of anger. In contrast, "anger in" is defined as the tendency to suppress angry feelings (Spielberger, 1988). Anger expression styles have been conceptualized as stable traits (Eckhardt et al., 2004).

In naturalistic studies, higher self-reported anger and anger suppression have been associated with a longer post-operative recovery and more post-surgical complications (Sharma et al., in press; Stengrevics et al., 1996). Those data suggest that anger might contribute to delayed wound healing. In addition, the expression of anger has been related to immune dysregulation. For example, family dementia caregivers who display high levels of anger out and low levels of anger control had a lower proliferative response to two mitogens than caregivers with low anger out and high anger control (Scanlan et al., 2001). Conversely, cardiac patients who had better control over the expression of their anger had higher natural killer (NK) cell cytotoxicity than patients who had poorer anger control (Ishihara et al., 2003). Furthermore, among men with prostate carcinoma, anger suppression has been associated with decreased NK cell cytotoxicity (Penedo et al., 2006).

Differences in pattern of anger expression have also been associated with cortisol secretion, an important endocrine modulator of wound healing. Momentary assessment studies revealed that feelings of anger and their expression are associated with cortisol elevations 20 min later (Adam, 2006; Adam et al., 2006). In a similar vein, hostile men who directed their anger toward their spouse during a marital interaction task exhibited higher glucocorticoid secretion than men who did not express angry feelings (Miller et al., 1999). Teachers experiencing high levels of job strain who tend to express their anger outwardly displayed higher early morning cortisol elevations compared to teachers who reported low levels of anger out (Steptoe et al., 2000). In addition, healthy volunteers frequently reporting suppression of their anger secreted more cortisol following acute laboratory psychological stressors (Larson et al., 2001).

Data from both human and animal models have linked enhanced glucocorticoid secretion with slower wound healing. Higher elevations in morning cortisol were observed in healthy men who were categorized as slow healers compared to those who were considered fast healers (Ebrecht et al., 2004). Similarly, higher levels of salivary cortisol were associated with lower production at the wound site of two cytokines essential for the integrity of the repair process (Glaser et al., 1999). In animal models, a glucocorticoid receptor antagonist attenuated stress-related decrements in wound repair, confirming the role of this stress hormone in delayed wound healing (Padgett et al., 1998; Detillion et al., 2004).

Several studies suggest that the health consequences associated with different patterns of anger expression differ by gender. For example, outward expression of anger has been associated with altered glucose metabolism among women, but not men (Suarez, 2006). Similarly, a curvilinear relationship between anger in and systolic blood pressure has been described among women, while anger suppression had no impact on blood pressure among men (Hogan and Liden, 2005). In addition, sex differences in cortisol responses to stress have been reported. Some studies suggest that after puberty, but before menopause, women tend to exhibit less cortisol reactivity to laboratory psychological stressors than men (Kajantie and Phillips, 2006; Kudielka and Kirschbaum, 2005). Therefore, gender might moderate the impact of anger expression on wound healing.

1.3. Relaxation and wound healing

This study was part of a project examining the effects of relaxation on wound repair. Psychological preparation before surgery appears to promote better adjustment and recovery in clinical settings (Kiecolt-Glaser et al., 1998). Moreover, relaxation interventions seem to facilitate recovery following surgery (Montgomery et al., 2002). However,