



A brief facial morphing intervention to reduce skin cancer risk behaviors: Results from a randomized controlled trial

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ABSTRACT

The current study was designed to test the efficacy of an appearance-based facial morphing program to reduce intentional UV exposure among individuals at risk for skin cancer. A three-arm randomized controlled trial was employed ($N=219$) comparing facial morphing + health information to: (1) mindfulness + health information; and (2) health information only. Participants were young adults with a history of recent intentional tanning and future intentions to tan. Primary outcomes were indoor and outdoor tanning frequency and tanning intentions, with secondary outcomes of tanning attitudes, body image, and affect. Facial morphing participants reported less frequent tanning, compared to mindfulness and control participants at 1-month follow-up. Facial morphing participants also generally reported lower intentions to tan at immediate follow-up, although the magnitude of these effects weakened at 1-month follow-up. Facial morphing programs may offer a brief, efficacious, and scalable augmentation to standard of care in reducing intentional UV exposure.

This trial is registered with clinicaltrials.gov (NCT03237013).

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1. Introduction

Skin cancer, inclusive of melanoma and non-melanoma types (e.g., squamous cell and basal cell carcinoma), is the most prevalent form of cancer in the United States (American Cancer Society, 2017; Siegel, Miller, & Jemal, 2017). In 2017, it was estimated that 87,110 individuals would be diagnosed with, and 9730 would die from, melanoma (Siegel et al., 2017). Further, in 2012, it was estimated that over 5 million U.S. citizens were diagnosed with non-melanoma skin cancer (Rogers, Weinstock, Feldman, & Coldiron, 2015). Indeed, the incidence of skin cancer has been steadily increasing over recent decades amongst most age groups (Jemal et al., 2011; Rogers et al., 2015), with some stabilization in melanoma rates among those under the age of 50 (Siegel et al., 2017). Despite the prevalence and incidence of skin cancer, it is also one of the most preventable forms of cancer (US Department

of Health & Human Services, 2014), underscoring the role of empirically supported prevention programs.

The leading behavioral risk factor for developing skin cancer is exposure to UV radiation (Narayanan, Saladi, & Fox, 2010). Excessive UV exposure is most commonly conferred through indoor and outdoor tanning. Researchers conducting meta-analyses have found significant associations between indoor tanning and the development of skin cancer (Colantonio, Bracken, & Beecker, 2014; Wehner et al., 2012). For example, there is a 29%–67% increased risk of developing non-melanoma skin cancer for individuals who have indoor tanned (vs. never tanned) and between 16% and 34% increased odds of developing melanoma. More recently, results from a population-based prospective cohort study revealed a 32% increased risk of developing melanoma among frequent indoor tanners (Ghiasvand et al., 2017). Additionally, initiating indoor tanning before the age of 30 was predictive of greater risk of developing melanoma, and younger age at diagnosis. Outdoor tanning has also been associated with a 71% increased risk of developing melanoma and a 38% increased risk of developing basal cell carcinoma (Armstrong & Kricker, 2001). Collectively, these findings highlight the public health burden of tanning behaviors, particularly among younger individuals.

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Individuals report varied motivations to engage in tanning behaviors; however, appearance-based motives are some of the most commonly noted in the literature (for reviews see [Coups & Phillips, 2011](#); [Holman & Watson, 2013](#)). In U.S. culture, skin that is more tanned tends to be viewed as more physically attractive than less tanned skin (e.g., [Chang et al., 2014](#); [Robinson, Kim, Rosenbaum, & Ortiz, 2008](#)). Thus, individuals may engage in tanning to move closer to this idealized skin tone. Indeed, results from previous research have consistently noted substantial associations between appearance beliefs and tanning behaviors and intentions ([Cafri et al., 2008](#); [Asvat, Cafri, Thompson, & Jacobsen, 2010](#); [Cafri et al., 2006](#); [Cafri, Thompson, Jacobsen, & Hillhouse, 2009](#)). [Cafri et al. \(2009\)](#) revealed that appearance-based variables both induce and reduce individuals' motivations to tan. For example, appearance based motives not to tan focus on the negative effects of UV exposure on the skin (e.g., wrinkles, sun spots), whereas appearance based motives to tan focus on the positive effects of UV exposure (e.g., appearing more fit, reducing the appearance of acne, avoiding looking pale). Given these findings, programs designed to reduce tanning behaviors may benefit from targeting appearance-based beliefs.

One intervention approach that seeks to explicitly target appearance based tanning beliefs are programs that directly focus on age-appearance changes due to tanning (for a review see [Williams, Grogan, Clark-Carter, & Buckley, 2013a](#)). Within this suite of interventions, researchers employing facial morphing (also termed facial aging) programs aim to highlight the negative impact of UV exposure on individual's skin by visually showing the changes in appearance that are likely to occur with continued UV exposure. This is typically accomplished by taking a digital photograph of a participant's face; uploading it into a computer program that demonstrates likely facial aging over time to underscore the changes that are likely to occur (or not occur) contingent upon continued UV exposure.

To date, two known trials ([Owen, Grogan, Clark-Carter, & Buckley, 2016](#); [Williams, Grogan, Clark-Carter, & Buckley, 2013b](#)) were specifically designed to focus on facial morphing technology to change tanning attitudes and behaviors have been published ([Heckman, Darlow, Ritterband, Handorf, and Manne, 2016](#) also tested a multicomponent intervention which facial morphing was one component). In the first published trial using this methodology, [Williams et al. \(2013b\)](#) compared facial morphing to a health literature condition, and tested effects immediately post-intervention on tanning attitudes, perceived sun damage susceptibility, and sun protection intentions among 70 undergraduate women. Results revealed significant treatment effects favoring the facial morphing condition, with participants reporting more negative attitudes toward tanning, increased sun protective intentions, and more perceived susceptibility to skin damage from the sun. Most recently, [Owen et al. \(2016\)](#) also compared facial morphing to a health literature condition, and tested immediate and long-term (6 months post-baseline) effects on tanning attitudes, sun protective intentions, and sun damage susceptibility among 70 undergraduate men. Results failed to reveal significant group differences at immediate or long-term follow-up. In sum, the published literature on facial morphing programs for tanning has produced mixed findings.

Although researchers have begun to test facial morphing programs for tanning, limitations in methodology currently limit conclusions. For instance, in the two aforementioned trials ([Owen et al., 2016](#); [Williams et al., 2013b](#)), researchers did not assess the intervention impact on actual indoor or outdoor tanning behaviors, or intentions to tan in the future. Additionally, in neither trial did researchers include time and attention matched control groups. Finally, previous researchers (e.g., [Blashill, 2013](#)) have suggested that facial morphing programs may exert iatrogenic effects (e.g., body dissatisfaction, appearance orientation, negative affect), as

the effects of interventions may inadvertently reinforce an appearance orientation by highlighting the negative impact UV exposure has on appearance. This is an important limitation, as if facial morphing reduces skin cancer risk behaviors, yet increases risk factors for maladaptive appearance changing behaviors (e.g., eating pathology), the utility of such intervention may be questioned. To date, however, there has been no empirical assessment of the potential negative outcomes of such programs.

With the above limitations in mind, the goal of the current study is to add incrementally to the literature base. Specifically, the research aims of the study are to further test the efficacy of a facial morphing program to reduce skin cancer risk behaviors by conducting a three-arm randomized controlled trial (RCT) comparing: (a) facial morphing+health literature to (b) health literature only (control), and (c) brief mindfulness+health literature (time/attention control). Brief mindfulness training was selected as a time and attention matched control, as previous research has found it to be efficacious in the prevention of other relevant health outcomes (e.g., smoking, negative affect, eating behaviors; [Díaz, Ramos Díaz, Jiménez Jiménez, & Lopes, 2014](#); [Marchiori & Papiés, 2014](#); [Rogojanski, Vettese, & Antony, 2011](#)). To our knowledge, these brief mindfulness interventions have yet to be applied in skin cancer prevention. In addition to assessing the efficacy of the facial morphing program across primary outcomes (i.e., frequency and intentions of indoor and outdoor tanning behaviors), we also assessed secondary outcomes—attitudes toward tanning—and possible iatrogenic effects via changes in state and trait-level body image variables (dissatisfaction and investment) and mood (affect, depression, anxiety, and stress) across post-intervention and follow-up (1-month post-baseline) assessments. Given the paucity of published research on these interventions, directional hypotheses were not generated.

2. Method

2.1. Participants, setting, and recruitment

The current study, titled “Strategies to Promote Skin Health,” was conducted during the Spring and Fall academic semesters between February and December 2016. Participants were undergraduate students recruited from an undergraduate research participation website at San Diego State University. A general description of the study's purpose which specified the study inclusion criteria and one's time commitment for study participation (i.e., a follow-up email would be sent out approximately one month following in-lab visit) was provided for potential participants upon sign-up. Inclusion criteria were: (1) age 18 years old or older; (2) enrolled as a student at San Diego State University; (3) engaged in either indoor or outdoor tanning at least once in the last 30 days; (4) intention to tan (indoor or outdoor) in the next 30 days; and (5) English speaking. All participants who completed the in-lab visit, consisting of the baseline assessment, treatment, and immediate post-treatment assessment, received one credit in undergraduate research participation. Those who completed the 1-month follow-up survey received a \$5 electronic gift card to a large, Internet-based retailer, delivered via personal email. All aspects of this study were approved of by the San Diego State University Institutional Review Board.

2.2. Study design

In the current study, a RCT was employed comprising three arms: facial morphing, mindfulness, and control. This trial followed CONSORT 2010 guidelines ([Schulz, Altman, & Moher, 2010](#)).

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