Sunsreen and Melanoma

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Sunscreen and Melanoma

Abstract

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Malignant melanoma is a rapidly increasing cause of death in the United States, currently rising at a faster rate than any other cancer. Sunscreen has typically been publicized as an effective prevention for skin cancer, including melanoma, but the research isn’t as clear. A literature review was conducted to examine what evidence exists and what role sunscreen plays in melanoma prevention. Twenty-one relevant articles were selected for inclusion. Evidence linking sunscreen use as a risk factor for melanoma and evidence for sunscreen’s protective factors were evaluated. The body of research concluded that evidence regarding sunscreen’s risk and protective factors thus far is contradictory and inconclusive. Until further research can be carried out on newer, broad-spectrum sunscreens, other methods of sun protection should be promoted and utilized. Patient education should also emphasize avoiding peak sunlight, wearing protective clothing, seeking shade, adequate vitamin D, and avoiding tanning beds.
Key Words: sunscreen, sun screen, melanoma
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Introduction

Melanoma skin cancer is currently a fast-rising cause of death. The incidence of melanoma is up 1800% since the 1930s (Soto et al., 2010). Melanoma is rising at a faster rate than any other cancer and takes sixth place as the most common type of male cancer and seventh place for female cancer. Specifically, the American Cancer Society estimated that 8,700 people would die of the disease in 2010 (The American Cancer Society, 2010). Although melanoma was uncommon in children and adolescents, a growing incidence was reported (Hoang & Eichenfield, 2000). In fact, melanoma is the most common type of cancer developed by young adults aged 25-29 (American Academy of Dermatology, 2010). As a rising cause of death, melanoma is currently under much investigation to determine methods of prevention and treatment. One of the most controversial methods of prevention is sunscreen.

For a number of years, sunscreen was publicized as an effective prevention for skin cancer, including melanoma. But recent research has created controversy. Some studies indicated no evidence proving sunscreen’s effectiveness in preventing melanoma (Gefeller & Pfahlberg, 2002; Vainio, Miller, & Bianchini, 2000), while others went so far as to identify a positive correlation between the sunscreen and melanoma (Autier et al., 1995; Westerdahl, Olsson, Masback, Ingvar, & Jonsson, 1995; Westerdahl, Ingvar, Masback, & Olsson, 2000). With a rising incidence and more deaths every year, it is vital that we avoid promoting a false pretense of prevention and determine whether or not sunscreen is an effective method of prevention for melanoma. A literature review was carried out in order to determine what research has been conducted on sunscreen and melanoma and what conclusions may be drawn from the research literature.
Literature Review

Methods

A literature search was carried out using PubMed.gov, CINAHL, and OVID using the keywords melanoma, sunscreen, and sun screen. The search was given a date limit of 1995, restricted to articles in English and 464 articles were identified. Articles were then filtered by title and abstract and pertinent articles were chosen. Articles focused on non-melanoma skin cancer, screening for melanoma, treatment of melanoma, or behavior of melanoma survivors were excluded. Articles specifically discussing the relationship between sunscreen use and developing melanoma were chosen. Twenty-one articles met these inclusion criteria and were grouped into categories of those a) linking sunscreen as a risk factor for melanoma, b) supporting the protective effect of sunscreen, and c) articles concluding the evidence is inconclusive.

Melanoma is defined as “the most serious form of skin cancer...characterized by the uncontrolled growth of pigment-producing cells” (American Academy of Dermatology, 2010).

Theoretical Framework

A number of theories could be useful in understanding the relationship between sunscreen and melanoma. Two theoretical models were chosen as a framework for this review, the Agent-Host-Environmental Model and the Health Belief Model.

Agent-Host-Environmental Model. The Agent-Host-Environmental Model, also known as Leavell and Clark’s Ecologic model (Leavell & Clark, 1965), examined the cause of disease in an individual. It noted that health is dependent “on the interaction of host, agent, and environment” (Daniels, 2004, p. 850). The agent functions as the factor that must be present or
absent for the illness to occur. The host is the living being that the agent affects. The environment is everything outside the host that makes the disease more or less likely. Understanding the cause of malignant melanoma includes these three factors. The causal agent is, at this point, unknown. The host is the individual at risk of developing melanoma. This literature review focused on the environment factor. Sunscreen is an object outside the host (human being) that impacts the likelihood of developing the disease. The purpose is to discover whether sunscreen makes the disease more or less likely, in order to retain the health balance between host, agent, and environment.

Health Belief Model. The Health Belief Model (HBM) was developed by Rosenstock in 1966 to explain why public health prevention programs were or were not effective (Hayden, 2009). The HBM model explains and predicts the use of preventative health behavior. It focuses on how a person’s perceptions impact their choices. The premise is that for an individual to make a successful behavioral change, they must have motivation to change, feel threatened by their current behavior, feel that the change will have a positive impact, and feel competent to make that change.

The healthcare provider is a key part of this process. Their information will motivate the patient and help them feel that their choices regarding sunscreen and cancer prevention will have a positive impact, minimizing the risk of developing melanoma. “People tend to adopt healthier behaviors when they believe the new behavior will decrease their chances of developing a disease” (Hayden, 2009, p. 32). An accurate understanding of the relationship between sunscreen and melanoma is vital to patient education and prevention of this disease.
Sunscreen as a Risk Factor for Melanoma

A number of studies discovered a positive correlation between sunscreen and melanoma, indicating that sunscreen may actually function as a risk factor for developing melanoma. A 1995 study in Europe showed a greater risk of melanoma associated with use of psoralen sunscreens (Autier et al., 1995). This case-control study questioned 418 persons with melanoma and 438 healthy controls. The results found a melanoma risk of 1.5 for regular sunscreens and 2.28 for psoralen sunscreens, supporting the hypothesis that sunscreen does not protect against melanoma (Autier et al., 1995).

Two studies in Sweden also revealed an association between use of sunscreen and melanoma (Westerdahl et al., 1995; Westerdahl et al., 2000). Westerdahl et al (1995) utilized a matched, case-control research design to collect questionnaire data from 400 persons with melanoma and 640 healthy controls. A significant association between using sunscreen and developing melanoma was found, with an adjusted odds ratio of 1.6 and an even higher adjusted odds ratio of 2.1 between the response categories of “almost always” versus “never use” (Westerdahl et al., 1995). Westerdahl et al (2000) used the same type of matched, case-control design, with an even larger participation of 571 persons with melanoma and 913 healthy controls. This study also found “a significantly elevated odds ratio (OR) for developing malignant melanoma after regular sunscreen use” even after adjusting for a number of factors, including sunburn history, hair color, frequency of summer sunbathing, and duration of sunbathing occasions (Westerdahl et al., 2000, p. 145). The adjusted odds ratio for the study was 1.8 and even higher in subjects who reported that using sunscreen allowed them more time in the sun.
The findings of Westerdahl et al (1995, 2000) came under criticism. The studies did not discuss the sun protection factor (SPF) of the sunscreen used or the application method. Additionally, some types of sunscreen such as psoralen are no longer widely in use. And as critics have pointed out, retrospective studies are subject to potential bias and confusion on the part of the participants (Bastuji-Garin & Diepgen, 2002). Participants’ responses may not be accurate and their subsequent experiences may color their memory and response.

Other studies investigated a potential hypothesis that specifies the reason sunscreen might function as a risk factor for melanoma: its use may encourage people to stay in the sun longer, increasing their exposure to harmful sun rays. This hypothesis is supported by two double-blind studies conducted by the European Organization for Research and Treatment of Cancer Melanoma (Autier et al., 1999; Autier et al., 2000). Specifically, the 1999 study examined 86 French and Swiss young adults during the summer holidays and found that use of a higher SPF sunscreen was associated with greater sun exposure. It was noted that “sun exposure of participants who used the SPF 30 sunscreen was, on average, 25% longer than that of participants who used SPF 10 sunscreen” (Autier et al., 1999, p. 1306) The 2000 study looked at 58 European young adults during the summer holidays, dividing them into groups using SPF 10 and SPF 30 sunscreens, and similarly found that when sunscreen was used during sunbathing, the duration of exposure to UV radiation was increased (Autier et al., 2000).

Additionally, a comprehensive literature review regarding sunscreen and sun exposure concluded that “sunscreen use leads to longer duration of sun exposure when sun exposure is intentional, but not when sun exposure is non intentional” (Autier, Boniol, & Dore, 2007, p. 1). The review analyzed evidence linking sunscreen use to extended time in the sun and noted that research strongly supports this conclusion.
The Protective Effect of Sunscreen

Empirical evidence for sunscreen’s effectiveness in preventing melanoma is generally lacking. A 1995 study of 1382 women in California (452 melanoma cases and 930 controls) found increased risk of melanoma with “lack of use of sunscreen” (Holly et al., 1995, p. 923). Also, an Australian case-control study of 406 adolescents found “no association between sunscreen use and risk of melanoma at home or on holidays (p. 95)”; however, “the only period of life for which there was an association with sunscreen use was under 5 years of age, when risk of melanoma was doubled for those who never/rarely used sunscreen at home(p. 95)” (Youl et al., 2002). But like many other studies examined, these two studies were population-based case-control studies and thus subject to criticism as retrospective studies; neither did they examine the SPF of the sunscreen used or the application method.

Additionally, a controlled study of 309 schoolchildren in British Columbia looked at sunscreen’s relationship to children’s development of nevi, concluding that “broad-spectrum sunscreens may attenuate the development of nevi in children and perhaps ultimately reduce their risk of developing melanoma” (Gallagher et al., 2000, p. 2960). While this may not be directly tied to melanoma, it did suggest the possibility of sunscreen’s protection. However, a similar study of 1,623 children in Perth, Australia, found that “using sunscreen on the back when it was uncovered was not associated with number of nevi” (English, Milne, & Simpson, 2005, p. 2875). Further, 631 children in 1998 had opposite results, concluding that “in white, European children, sunscreen use appears to be associated with development of nevi, probably because it allows longer sun exposure” (Autier et al., 1998, p. 1873). This conflicting information made a clinical and scientific conclusion difficult.
A recent study from Australia (2010) seemed to provide some evidence supporting sunscreen’s protective effect. From 1992 to 1996, 1,621 participants were randomly assigned to two groups, either daily sunscreen use or discretionary sunscreen application. Questionnaires and/or pathology laboratory tests were completed until 2006. Factors such as age, sex, phenotype, sun exposure, and history of skin cancer were accounted for by data analysis using sub-groups. Results indicated that “melanoma may be preventable by regular sunscreen use in adults”, with a reduction in melanoma development in those assigned to daily sunscreen use (Green, Williams, Logan, & Strutton, 2010, p. 1). The researchers were optimistic about the result, yet it was noted that “the result was of borderline statistical significance” (Green, Williams, Logan, & Strutton, 2010, p. 4). A critical review of the study also pointed out that both the reduction of in situ and invasive melanomas could be considered of borderline significance, noting that “there seems to be some contradiction between the authors’ conclusions and the $P$ values that were reported” (Gimotty & Glanz, 2010, p. 1). This is the only study of its type and while it provided new, crucial evidence, continued research is needed.

Despite this lack of any substantial evidence for sunscreen’s effectiveness in preventing melanoma and even questions about its correlation with melanoma as seen previously, a number of researchers supported its use as a protective measure for minimizing the risk of melanoma. Reviewing the current research, Weinstock (2000) criticized negative conclusions about sunscreens and points out that current sunscreens provide better coverage against UVA as well as UVB radiation. He asserted that despite concerns with sunscreen, its use, and potential false security, sunscreen is effective in reducing the risk of melanoma. His evidence came from randomized trials revealing sunscreen’s effectiveness in reducing actinic keratosis and
preventing nevi in children, but no clear evidence supporting sunscreen’s protective affect against melanoma is given.

In a review of previous literature, Diffey (2005) addressed the lack of evidence supporting sunscreen’s protective effect, asserting that given the age of previous studies and the types of sunscreen available at that time, this lack of evidence is not surprising. “In 1984 the median Sun Protection Factor (SPF) of sunscreen products used in Europe was 4-6, but this had risen to 6-10 by 1987…” (Diffey, 2005). Problems with data interpretation were also referenced, pointing out that positive and negative confounding factors exist, such as the fact that people at the highest risk of developing melanoma are more likely to use sunscreen. Additionally, common sunscreen use does not meet recommended application methods. Thus with studies based on old sunscreens, poor methodology, and poor application, the results are to be expected. The article pointed out that modern sunscreens have improved in their performance and better UV filters are now available. Broad spectrum sunscreens protect against both UVA and UVB rays; additionally, sunscreen is now available in more popular forms such as “lotions, milks, gels, sticks and sprays” (Diffey, 2005). For these reasons, Diffey believed it is reasonable to expect modern sunscreen to function as a beneficial preventative agent. However, the author also admitted that these benefits may not be evident for several decades.

Similarly, in an article discussing sunscreen and skin cancer in general, Dummer and Maier (2002) supported the likelihood that sunscreen reduces melanoma risk. They acknowledged the lack of direct evidence, but cited information regarding UVA and UVB rays, as well as the conflicting studies indicating that sunscreen may reduce the number of nevi children develop. These researchers were optimistic and offered some logical explanations, but
as many of them acknowledge, their research articles provided mostly conjecture for now until further research is completed.

**Evidence is Inconclusive**

The broadest body of research and review indicated that evidence regarding sunscreen’s effect on melanoma is currently inconclusive and controversial. In 2000, a working group of experts with the International Agency for Research on Cancer (Vainio et al., 2000) looked at 15 case-control studies, including many discussed above, and found inconsistent results. They determined that “no conclusion can be drawn about the cancer-preventive activity of topical use of sunscreens against basal-cell carcinoma and cutaneous melanoma” (Vainio et al., 2000, p. 841).

A comprehensive literature review compiled and categorized evidence available on the topic and concluded that results are controversial and research is not in agreement (Bastuji-Garin & Diepgen, 2002). The review discovered research both supporting and denying the protective effects of sunscreen, but also found weaknesses, including biases, lack of multivariate analysis, lack of dose-effect relationship, and poor methodology.

Gefeller and Pfahlberg (2002) similarly conducted a literature review and concluded that “current empirical evidence does by no means allow the claim for a proven melanoma protective potential (p. 154)” and recommended that public awareness campaigns change their focus, emphasizing other preventative measures such as protective clothing and minimizing sun exposure. Autier (2001) similarly acknowledged conflicting evidence and advised that while sunscreen may be a helpful potential, priority should be given to clothing and sun exposure. Likewise, a 2003 comprehensive review of literature found no association between melanoma
and sunscreen use and indicated that much time may be needed to provide evidence for the effectiveness of current sunscreens (Dennis, Freeman, & VanBeek, 2003).

These literature reviews provided a thorough, comprehensive look at sunscreen’s ability to protect against melanoma. By identifying available information, critiquing research methods, compiling evidence, and summarizing the information available thus far, they offered an excellent review of existing evidence. For now, the indication seems clear: no assumptions can be made.

**Discussion**

The positive relationship between using sunscreen and developing melanoma is tentative, due to the limitations of retrospective studies. But the link between using sunscreen when the sun exposure is intentional, is stronger. It appeared that sunscreen may be increasing the risk of melanoma by encouraging extended exposure in the sun. Sunscreen may give its users a sense of false security about how much protection they are receiving; yet, paradoxically, its use may increase risk. Further, no empirical evidence presently indicates that using sunscreen effectively prevents melanoma. Sunscreen should not be depended on as the sole method of prevention.

While sunscreen may still be a helpful measure, emphasis by providers and public awareness campaigns should be given to other prevention tactics as well, such as those provided by the American Academy of Dermatology (AAD). In addition to using SPF 30 (or greater) sunscreen, the AAD recommends avoiding peak hours of sunlight, using UV protective clothing, seeking shade when possible, getting vitamin D safely through diet and supplementation, obtaining yearly skin exams, and avoiding tanning beds (American Academy of Dermatology, 2010). Despite these recommendations, a 2004 international literature review found that
“sunscreen was the most frequently used method of sun protection across all age groups, despite recommendations that this form of protection should be an adjunct to other more natural forms of protection”, such as protective clothing and shade (Stanton, Janda, Baade, & Anderson, 2004, p. 373). It is clear that more education is needed. Cancer advocacy groups have historically sponsored public education campaigns to promote the use of sunscreens to prevent skin cancer. It is unlikely that consumers will see any change in skin cancer prevent campaigns until the evidence for use of sunscreens incontrovertible. Nurse practitioners can inform people of the risk and benefits of using sunscreens, assist them in making an educated choice, and encourage use of the AAD’s safe sun practices.

However, sunscreen formulation has improved and more research is needed to determine whether current sunscreens with new UV filters are an effective preventative measure against developing melanoma. Further research may give evidence for current sunscreen’s protective effect and for now, using recommended sunscreen in combination with other sun protective practices is likely the best method of prevention.
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