

# UV Radiation Exposure in Welders: Impact on the Skin and Eyes

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## PRACTICE POINTS

- Arc welding can be a major source of UV radiation exposure.
- Welders should be advised to work with proper ventilation and with welding masks, clothing, and gloves that not only are fire retardant but also are UV resistant.

Arc welding is an occupation with exposure to intense bursts of UV radiation (UVR). Although industrial settings may be aware of UV light exposure during welding, physicians may be unaware of this source. We report 3 welders with skin diseases that may have been caused or exacerbated by occupational UV light exposure: refractory subacute cutaneous lupus erythematosus, diffuse actinic damage spared by the area protected by safety goggles, and squamous cell carcinoma developed outside of the area protected by a face shield. We review UVR exposure in arc welders, cutaneous adverse effects, and safety recommendations.

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Although solar radiation is the most commonly recognized source of UV radiation (UVR), occupational exposures can contribute due to the intensity and chronicity of exposure. Arc welding is a process whereby metal is fused together by heat produced from an electric arc. The electric arc that forms between the electrode and the base metal emits radiation in the full UV spectrum including UVA (400–315 nm), UVB (315–290 nm), and UVC (290–100 nm) wavelengths. Welders, therefore, have an increased risk for broad-spectrum, intense exposure to UVR, which may play a notable role in UV-related skin disease without proper

protection. We report 3 welders with skin disease attributed to occupational exposure to UVR.

## Case Reports

**Patient 1**—A 41-year-old man presented for evaluation of treatment-resistant cutaneous lupus. During the 10-year disease course, the patient was treated by both dermatologists and rheumatologists with frequent exacerbations and poor disease control. At the time of presentation, treatment with hydroxychloroquine 200 mg twice daily, azathioprine 50 mg twice daily, intramuscular methylprednisolone acetate injectable suspension 40 mg, and prednisone 20 mg daily was failing. Physical examination revealed polycyclic erythematous plaques typical of subacute cutaneous lupus erythematosus. A skin biopsy confirmed the diagnosis. Upon further discussion of exacerbating risk factors, the patient noted UVR exposure while working as a welder. Although he had been previously told to avoid sunlight, he did not realize that this recommendation included all forms of UV light. Once this work exposure was eliminated, he was restarted on hydroxychloroquine 200 mg twice daily and topical steroids, and he responded with complete and sustained clearance of disease. When he returned to welding, utilization of sunscreen and sun-protective clothing enabled him to maintain control of his subacute cutaneous lupus erythematosus on oral hydroxychloroquine 200 mg twice daily and topical steroids.

**Patient 2**—A 55-year-old man presented with numerous actinic keratoses and persistent erythema in a well-demarcated area involving the forehead, temples, and lateral cheeks but sparing the periorbital area. The patient also experienced UVR exposure from welding (up to 4 to 5 times per week during his career spanning more than

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20 years). He cited frequent burns in areas where his protective equipment did not cover his skin. He also reported that he often forgoes wearing protective equipment, even though it is available, and only uses safety goggles due to the extreme heat of the working environment as well as the awkwardness of wearing full protective gear while performing certain aspects of the job.

**Patient 3**—A 63-year-old man presented with a growth on the left side of the upper forehead. A biopsy revealed a squamous cell carcinoma, keratoacanthoma type. He worked as a welder for 40 years until retiring 1 year prior to presentation. He welded daily and always wore a tall face shield. Although the face shield covered most of his face, the scalp and some parts of the upper face were not well protected. In addition to the keratoacanthoma, which presented just outside of the area protected by the face shield, the patient had numerous actinic keratoses on the scalp.

### Comment

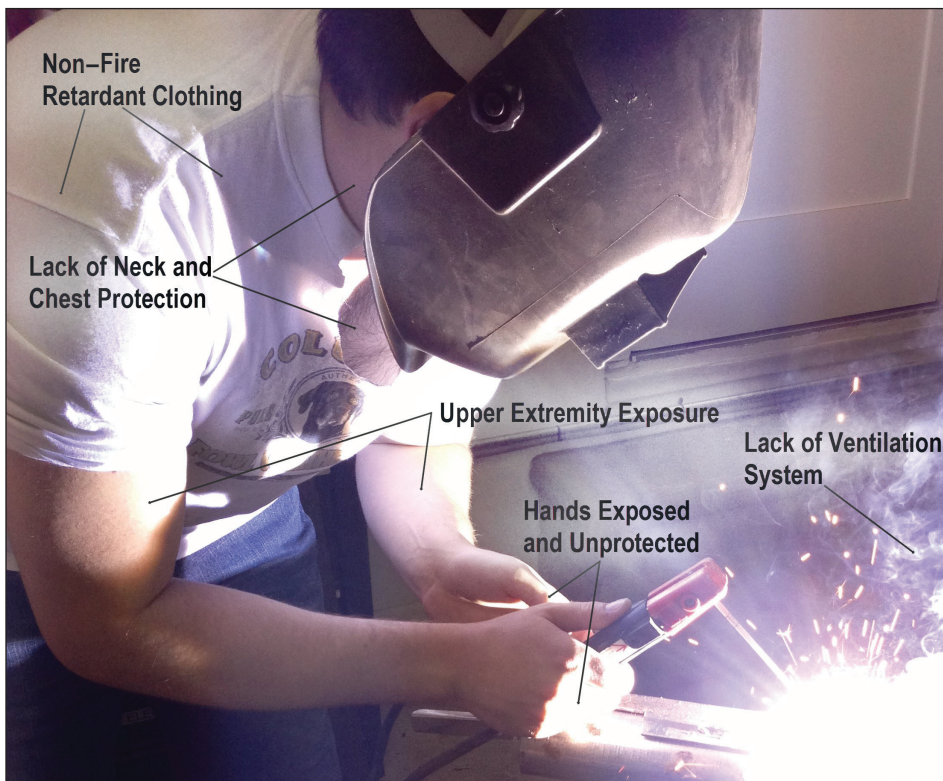
**Welding and UVR Exposure**—Arc welders endure large amounts of UVR exposure, which is substantial enough to have notable health effects. The duration of exposure, electrical current used, angle of exposure, amount of ventilation, and the distance from the welding arc play a role in overall UVR exposure.<sup>1,2</sup> Maximum permissible exposure (MPE) limits to UVR have been set by the International Commission on Non-Ionizing Radiation Protection and the National Institute for Occupational Safety and Health.<sup>3,4</sup> The quantity of radiation produced

by the arc allows for an exposure time of only a few seconds to minutes before surpassing MPE to UV light.<sup>1,5</sup> Welders are exposed to total-body UVR doses up to 3000 times the MPE, and mean cumulative exposure calculated over an 8-hour workday can reach 9795 mJ/cm<sup>2</sup>.<sup>6</sup>

Workers in close proximity to welders also receive large UVR doses and may not be aware of its hazardous effects. Nearby nonwelders can be exposed to 13 times the MPE of UVR.<sup>6</sup> At distances up to 10 m from the arc, the irradiance is large enough to reach MPE to UVR in less than 3 hours.<sup>1</sup>

**Skin and Eye Damage From Welding**—Exposure to UVR produced by the welding arc may lead to acute skin or eye reactions, chronic skin or eye disorders, or exacerbation of photosensitive diseases. Common acute problems are photokeratoconjunctivitis (welder's flash) and skin erythema.<sup>7,8</sup>

Actinic elastosis, actinic keratoses, ocular melanoma, and photosensitive diseases represent a spectrum of disorders that can present from chronic UV exposure in welders. In a study by Emmett et al<sup>7</sup> of 152 welders and 58 controls, actinic elastosis was found to be more frequent in welders than controls. Cases of basal cell carcinoma and squamous cell carcinoma also have been reported in welders.<sup>9,10</sup> However, in the study by Emmett et al,<sup>7</sup> a statistically significant correlation between welding and skin cancer was not documented. There were limitations in the study, such as small sample size and a young average age of welders.<sup>7</sup> Future studies may be needed to further clarify the risk for skin cancer in welders.



An amateur welder without full personal protective equipment, leading to UV radiation exposure.

Although there is no clear association with skin cancer, an increased risk of ocular melanoma in welders is more clearly established. A meta-analysis of 5 studies found that welding was a significant risk factor for ocular melanoma, with an odds ratio of 2.05 (95% confidence interval, 1.20–3.51).<sup>11</sup> Other reported eye damage from chronic UVR exposure includes cataracts, chronic conjunctivitis, and retinal damage.<sup>12,13</sup>

Case reports of the following photosensitive diseases have been reported to be exacerbated or caused by UV light exposure in welders: discoid lupus erythematosus<sup>14</sup>; photodermatitis<sup>15</sup>; broadband photosensitivity with decreased minimal erythema dose to UVA, UVB, and UVC<sup>16</sup>; UVC-exacerbated atopic dermatitis<sup>17</sup>; polymorphous light eruption–like skin eruption<sup>18</sup>; and UVA-induced photoallergy to hydrochlorothiazide and ramipril.<sup>19</sup>

*Prevention of Occupational Exposure to UVR*—Occupational Safety and Health Administration guidelines protect workers from excessive exposure to UVR with personal protective equipment (PPE). In addition to UVR protection, PPE needs to protect welders from other risks including trauma from welding debris (slag), fires, electrical burns, and fumes. Online resources from the National Ag Safety Database,<sup>20</sup> the American Welding Society,<sup>21</sup> and Occupational Safety and Health Administration<sup>22,23</sup> are available. These resources advise welders to work in ventilated areas with respirators specific for the metal being welded and to wear clothing and gloves that are not only fire retardant but also UV resistant.<sup>20–23</sup> Additional PPE should protect the head, face, and eyes.

Unfortunately, even workers well trained in prevention guidelines may not adequately protect themselves. Some welders forego PPE due to heat, thus exposing themselves to UVR damage in areas that are normally covered. Welders also may forego equipment when working on jobs requiring more detailed welds where clothing, masks, and glasses may be overly bulky and inhibit the worker's precision. Nontraditional welders, such as artisans or handymen, may not have workplace safety education to be aware of UVR emitted from welding and may not have readily available PPE.

The Figure portrays an amateur welder working without full PPE. Although he is wearing a face shield, he is not wearing fire-retardant clothing, lacks full protective garments, and has no ventilation system.

## Conclusion

It is important to recognize welding as an occupation with notable exposure to UVR. Personal protective equipment should be the mainstay of prevention. Sunscreen is a useful adjunct but does not cover UVC that is emitted in the welding arc. Screens and welding blankets can be placed around welders to contain UVR and limit non-welder exposure. Although UVR hazards should be regulated in the workplace as part of regular safety reviews,

the clinician can play a role in recognizing this source of UVR in skin disease and in encouraging the use of PPE.

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