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Araştırma/Research

Ark Kaynak Kaynaklı Ultraviyolenin Kornea Yapısına Etkisi

Ali ŞİMŞEK[1], Tanju TEKER[2], Eyyüp Murat KARAKURT[2], Alper YALCIN[3]

[1] Adıyaman University, Medcal Facutty, Department of Ophthalmology.
[2]Adıyaman University, Faculty of Engineering, Department of Metallurgical and Materials Engineering.
[3]Adiyaman University, Medical Faculty, Department of Histology and Embryology,

ÖZ

Amaç: UV'nin kornea üzerindeki etkilerini değerlendirmek.

Yöntem: Tüm hastalara yarık lamba muayenesi yapıldı. Bir tedavi verildikten sonra kontrolera uygulandı. Sodyum floresein kornea epitel patolojisini göstermek için kullanıldı. Hastalar ağrı, kızarıklık, noktalamalı keratit ve konjonktivit belirtileri kaydettik. Ön segment görüntüleri değerlendirildi. Kornea epitelindeki değişiklikler değerlendirildi. Hastalara koruyucu gözlük takma ya da takmama incelendi.

Bulgular: 520 hastanın 102'sinde (% 19.62) Birinci başvuru, 172 hasta (% 33.07) 2-5 başvuru grubunda, 72 hasta (% 13.85) 5-10 başvuru grubunda ve 174 hasta (% 33.46) 10'dan fazla başvuru vardı son 4 yılda. 325 hasta (% 62.5) güvenlik gözlüğü kullanmazken, 195 (% 37.5) hasta güvenlik gözlüğü kullandıklarını ifade ettiler.

Sonuç: Altmış hastanın 54'ü erkek, diğerleri kadın idi. Ortalama yaş sırasıyla 47.5 ± 10.5 ve 33.15 ± 12.95 yıl (18-75 yıl arasında değişmektedir). Hastaların% 95'inde göz ağrısı,% 5'inde göz kızarıklık,% 100'ünde noktalanmış keratit elde izlendi. Hastaların% 60'ı konjonktivit tespit edildi.

Anahtar kelimeler: kornea; ultraviyole radyasyon; iş güvenliği; koruyucu gözlük.

Yazışmadan Sorumlu Yazar
Ali ŞİMŞEK
Adıyaman Üniversitesi, Eğitim ve Araştırma Hastanesi, Göz Hastalıkları Anabilim Dalı, Adıyaman.
Tel : +90 **05302227760**
Email: alisimsek1980@gmail.com

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Effect on the Cornea Structure of the Ultraviolet Emitted From the Arc Welding

Abstract

Purpose: To evaluate the effects of Ultraviolet (UV) on the cornea.

Materials and Methods: All patients underwent slit lamp examination. After being given a treatment kontrolera were performed. We used to show Sodium fluorescein corneal epithelial pathology. Patients pain, redness, we have recorded the punctate keratitis e conjunctivitis symptoms. Anterior segment images were evaluated. Changes in corneal epithelium were evaluated. Patients were examined whether or not to wear protective goggles.

Results: Fifty-four of the sixty patients were men and the others were female. Average age are 47.5±10.5 and 33,15±12,95 years (ranging from 18 to 75 years) respectively. 95% of the patients were also cause eye pain, it has been obtained eye redness in %5, punctuate keratitis in %100 of patients. 60% of the patients had conjunctivitis.

Conclusions: Ultraviolet radiation causes damage on corneal structures, depending on the wavelength and exposure time.

Key Words: Cornea; ultraviolet radiation; occupational safety; protective glasses.

Introduction

Optical radiation in the electromagnetic spectrum includes ultraviolet (UV), visible light and infrared radiation. UV exposure can be acute or chronic. The most harmful UV effect that affects anterior pole of the eye seems to be that generated by voltaic arc of welding devices. This can explain the development of some ocular diseases at welders (1).

In general welding is used in the manufacturing, maintenance and repair work as a manufacturing method (**Figure 1**). It is different form casting or forging. The main principle of this process, it is to add to each other the touching locations of the welded parts by heating up to the melting temperature or using filler material of the same composition (2). Welding Technology, which rapidly has been improving in parallel with the world of technology, shows new advances day by day. Previously welding technology only was used to in the repair of damaged parts. But, recently it is production process in space, air, land, sea, and undersea vehicles and in the linking continents pipeline, the foundations of the chemical industry forming pressure vessels and reactors, steam boilers, the construction of nuclear reactors. Welding technology also find application field for the production of not only heavy items as indicated above but also a very small element, for example; used in many electronic devices, such as hundreds diode, resistance, output terminals of the integrated circuit comprising circuit elements in the flake size are welded under the microscope by using specific methods (3).

As it is known today, different welding methods for metallic and non-metallic many materials are applied in combining. In addition, improvements on the welding technology have further accelerated with the developments in electronics and computers. Welding technology has become widespread because of the solution of the mainly initial problem. These new applications of modern welding methods are carried on their development by the new request (4). Except for a very small part of welding methods, all methods practically need to be heated until the melting temperature of welding location. Heat sources used in welding technology depend on practices such as electric arc, electric resistance heat, frictional heat, oxy-acetylene flame, or electron beam (5). Power is the rate of conversion of energy from one to another. When welding arc given, almost all of the electrical energy is converted into heat. Only small parts of the heat emitted by the arc diffuse as bright infrared and ultraviolet rays (6).

Figure 1. Welding process in the service area.

1.1. The Risk of the Ray Emitted From Arc Welding

In general, approximately 15% of the arc energy in the welding process spread to the operating environment as a radiation. %10 of energy as ultraviolet, %30 of energy as bright and % 60 of energy as infrared rays spread out environment (**Figure 2**). These rays are classified by wave length (7). Each of these rays leads to different health problems for human (2).

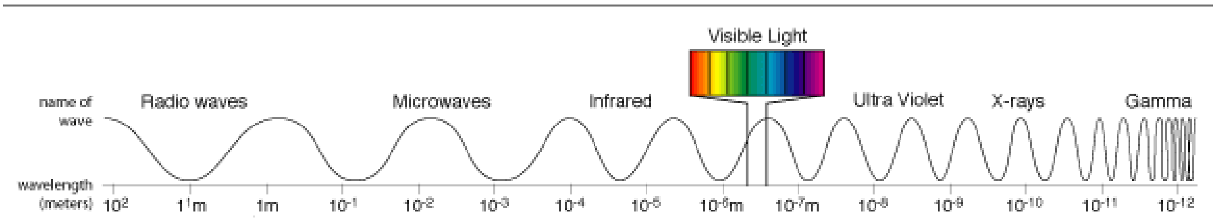

Figure 2. Classification of the electromagnetic waves.

The ray emitted from arc welding is radiation. The type and quantity of radiation in the welding depend on background processing and the melting temperature of the metal. All radiation is considered as hazardous. Radiation can be classified in two ways, such as, ionized or non-ionized rays. Example of the ionized radiation is X-rays. Electrons occur on electron beam welding. Thorium tungsten electrode used in the TIG welding arise from rupture and fragmentation (these parts are radioactive). Example of the non-ionized radiation is infrared (IR) and UV (ultraviolet) rays. These rays are visible. Infrared radiation result from hot metal flame or arc and it affects just like the heat of burning fuel. Ultraviolet radiation which is not felt by the skin just shows the effect of sunburn on the skin. Wavelength of this radiation is important for the eye health of the employees. Ultraviolet rays cause the most damage in the eyes of employees. It has 4,000 to 8,000 Angstrom (=10 $^{-7}$mm) wavelength and high energy. Unless employees are exposed to this radiation without wearing face shield or frame goggles, they try to protect their eyes from the effects of this radiation by closing or squinting. Ultraviolet ray which has 100-4000 Angstrom wavelength causes damage on the eyes of employees. In addition, due to the fact that that ray cannot be seen, it is impossible to protect the aid of the eye reflexes. Hands and face of workers should be protected to not be adversely impressed by rays emitted from welding or cutting. Otherwise, burning eye, bloodshot, and redness can be observed in employees. Such health problems may occur during welding and cutting in the acute (short-term). Due to resulting in long-term (chronic) eye disorders, employees in welding and cutting result in the loss of vision in varying proportions and permanent blindness disease. Depending on the wavelength of the radiation, it causes permanent damage such as blindness and cataract disease (2).

1.2. Investigation of the Effect on the Cornea Structure of the Ultraviolet

Ultraviolet (UV) keratitis is a self-limited, inflammatory condition can be lead to pain and temporary visual disturbance following acute UV radiation exposure (8). Ultraviolet (UV) keratitis is relatively rapid in both onset and resolution. The clinical syndrome is characterized by onset of the significant ocular pain and decreased acuity between 6 and 12 hours after exposure to a welder's arc or a tanning lamp. These rays are effective in the first and most corneas. A superficial punctuate keratitis, typically bilateral, develops early; in severe cases, this objective is frequently followed by total epithelial desquamation. Conjunctive chemosis, lacrimation, and blepharospasm are also usually present. Corneal reepithelialization, aided by lubrication, patching of the eye, or a bandage contact lens, occurs over a 36- to 72-hour period. Long-term sequelae are rare. This is in contradistinction to damage to the epithelium from certain chemicals (e.g., alkalis and strong acids) where re-epithelialization is often delayed or abnormal (9).

In our study, we evaluated the effects of UV on cornea

Materials and Method

In this study, the 60 patients who have been exposed to the ultraviolet radiation in arc welding have been examined into changes in the structure of the cornea between 2012-2014 time periods. We studied patients admitted us in the remaining eye clinic and after exposure welding arcs. We retrospectively reviewed all cases of UV keratitis that occurred on welder's arc from 2012–2014. All procedures followed the Declaration of Helsinki rules and informed consent was obtained from the participants. The study was approved by the institutional ethic committee. Participants were recruited from Ophthalmology clinic at Adıyaman University Education and Research Hospital. Sixty patients were participated in the study. All patients underwent slit lamp examination. Control examinations were performed after being given treatment. We used to show Sodium fluorescein corneal epithelial pathology. We have determined the punctate keratitis and conjunctivitis symptoms on the patients, who suffered from pain and redness. Moreover, anterior segment images were also evaluated. Changes in corneal epithelium were investigated. Patients were examined according to whether or not to wear protective goggles.

Results

Fifty-four of the sixty patients were men and the others were female. Average age are 47.5±10.5 and 33,15±12,95 years (ranging from 18 to 75 years) respectively. 95% of the patients were also cause eye pain, it has been obtained eye redness in %5, punctuate keratitis in %100 of patients. 60% of patients would like to participate in the event conjunctivitis (**Figure 3**). Thirteen of the 42 (70%) cases occurred in participants who were not wearing protective glass. 18 cases (30 %) occurred in participants who were wearing protective glass.

Figure 3. Redness of the eye.

Discussion

The eyes must be also protected against infra-red and UV rays emitted from welding in addition to the chemical mechanical and thermal irritants. To that end, welding goggles and welding mask must be used against hot particles and radiation. Permeability of welding goggles depends on the quality of consisting ray. The environment of the weld zone must be covered with opaque panels or curtains to protect welder from hazardous radiation. Panels must be made from portable materials. Thick canvas or UV absorbing plastic material should be used in accordance with this purpose. Yellow, green or orange panels should be chosen to reduction the reflections in plastic curtains and panels and the glare. However, curtains and panels should be kept away from fire in case plastic curtains or panels are used, and the airflow must not be obstructed.

The cornea is the transparent and avascular structure, which allows the transmission of incident light to posterior ocular structures. It is a structure constantly exposed to a wide spectrum of radiation including UV light (10). According to some studies, the adverse effects of UV radiation include corneal stromal thinning, keratoconus, corneal vascularization, fibrosis and keratosis (11, 12). The best-known effect of acute exposure to UV radiation is photokeratitis, characterized by enhanced apoptosis and exfoliation of the corneal epithelium, the appearance of ulceration, inflammation and edema of the corneal stromal structure, giving a sensation of ocular discomfort. Pathology caused by chronic exposure is varied, comprising numerous corneal and conjunctiva ailments such as pterygium and keratopathy (13, 14).

Previous studies reported that damage caused by exposure to UV radiation depends on numerous factors, such as the wavelength and the exposure time (15). Experimental studies have shown that UV radiation and resulted reactive oxygen species produce large morphological changes in the cornea (16). In our study, besides the anterior epithelial lesions, we observed at the level of the stroma the appearance of an intense inflammatory reaction, with numerous lymphocytes and macrophages, increased in anterior part of the corneal stroma. In our study, we noted a strong relationship between microvascular density and the intensity of the inflammatory infiltrate.

Conclusion

Ultraviolet radiation causes damage in all of the various corneal structures, depending on the wavelength and exposure time. Ultraviolet radiation causes damage in all of the various corneal structures, depending on the wavelength and exposure time.

It was observed that workers' protective glasses usage rates were low in working environments. Patients most commonly refer to ophthalmologists with eye pain. Appropriate eye protection, including adequate glass with appropriate side shields should be worn in work environments in order to prevent UV keratitis.

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