# The Effects of Fluorescent Light on the Ocular Health of Persons with Pre-Existing Eye Pathologies

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Fluorescent light is the most common source of lighting today for industry and commerce. The cool white fluorescent tube is the light source of choice for most designers of interior spaces. Fluorescent light is cheap, efficient and long-lasting and the tubes are available in a wide array of styles and choices, from the common cool white fluorescent tube (4100K and 5000K) to specialty tubes such as plant growth tubes and actinic tubes for aquarium lighting.

Most schools are lit with cool white fluorescent tubes as well, owing to the qualities of economy and long life afforded by them. However, recent studies in cellular activity of the human retina indicate cool white tubes or daylight tubes should probably not be considered as a good lighting source for persons with eye disease or eye injury.

When the eye is healthy and carrying on the process of photoreception, each photoreceptor in the retina does one unit of work for each peak in a wavelength of light which strikes it. Each unit of work done by a single photoreceptor, generates one unit of cellular waste product which must be carried away by the eye's natural system of waste disposal.

In the diseased or injured eye, the natural system of waste disposal is often compromised. Thus, while the retinal cells are working hard to process light information, they often produce more waste product than the eye's disposal system can handle. Waste products build up in the eye and are perceived by the brain as "glare."

Glare is often characterized as "fog, whiteness, blackness, or an irritating feeling." Whatever it is, it's unpleasant to the person who experiences it. For the person suffering from diseased or injured eyes, it is more than unpleasant, it can be extremely painful and it can last a very long time after the source of light is removed.

How does cool white light, or light with an output in the predominantly blue portion of the spectrum exacerbate glare? It is simple mathematics. For every peak in a lightwave which strikes a photoreceptor, the cell does one unit of work. UV and light in the blue part of the spectrum have peaks which are very close together,

working the eye at a much higher rate than that of the warm white (2700K) fluorescent tube. Conversely, light in the red part of the spectrum, tends to allow the retinal cells to operate at a slower rate, often giving them a better chance to keep pace with the disposal of the by-products of photoreception. This then, results in less glare.

It is not too harsh to state that virtually all persons with vision problems should be removed from a light environment where the predominant light waves are a temperature above 3500K or a wavelength less than approximately 500 nm.

Not only is it uncomfortable for persons with diseased or damaged eyes, there is adequate information available to safely state blue light, in addition to UV, causes irreparable damage, over time, to the human retina, especially in young children. Numerous studies by Dr. Chen of Sweden and Drs. Ham and Ruffolo, suggest it is wavelength alone, not duration or intensity which is responsible for cellular damage and death in the presence of blue light. Serious consideration as to how we light environments of persons with visual problems cannot come too soon.

While warm white fluorescent tubes are a much better environmental choice than cool white; incandescent bulbs offer an even better environment. Because of the slow processing of visual information in the diseased or injured eye, many persons with limited vision are able to perceive the flicker in fluorescent lights which is imperceptible to persons with healthy eyes. While this does not present a health problem to most people (persons with epilepsy are excepted,) it does become a source of annoyance for some.

If a school, workplace or home has the choice between fluorescent and incandescent light, then incandescent bulbs, which are translucent, but not transparent and have a strong spike in the red end of the spectrum are preferred. However if the choice is limited to cool white vs warm white fluorescent, then warm white tubes are the obvious choice.

If overhead warm white tubes are selected, they can perform even better for the low vision user by the addition of a 1” peracube lens. This lens looks like a silver grid with cross pieces being 1” apart. Acrylic or Lucite lenses, which look more like sheets of semi-translucent material over the tubes, tend to scatter the light throughout the room and thus rebound it within the eye several times. Use of these lenses should be discouraged.

A new product, the RobinSpring 32 lamp, is now available. Even though it is flourescent, it employs a new technology which reduces the flicker rate to almost nothing. Additionally, it uses a combination of fluorescent and and other lamp technologies to produce light that is in the 3200K range. It is perfect for most persons with compromised vision, and those persons with typical vision for whom typical fluorescent lighting is not advisable.

It is important that those of us who make decisions about the environments of others, especially children, take the safety and the comfort of their visual experience into consideration.

## Resources and References


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