EnChroma Glasses and Color Vision Deficiency

Abstract

EnChroma glasses are an innovative line of eyewear that can reveal a new world of color to people with color blindness or Color Vision Deficiency (CVD). The glasses were originally developed by Dr. Don McPherson to aid surgeons during operations. However, McPherson discovered their potential to aid individuals with CVD when he lent them to a colorblind friend (Zhou). The glasses function by redistributing red and green portions of the color spectrum in the correct ratios to their respective photoreceptors in the eye. They work to correct red-green colorblindness, the most common form of CVD (Zhou). EnChroma’s technology can help eighty percent of affected individuals to have improved vision (Barnwell). The bleeding edge technology used to design and manufacture the lenses result in the final product being quite expensive. The cost is a significant hindrance that prevents many people with CVD from being able to experience the possibly life-changing benefits of EnChroma glasses. Even though the glasses do not cure CVD, similar to how regular glasses do not cure near-sightedness, the lenses offer enough benefits to justify inclusion in vision health plans. Some insurance companies already cover EnChroma glasses that are made for near sightedness and other types of recognized visual impairments (“Top Questions”). If insurance companies begin covering EnChroma lenses, they would be helping a significant portion of the population to benefit from this amazing technology.

Problem Statement

Contrary to the meaning implied by its name, people who are “colorblind” are not incapable of seeing colors. The correct term is “color vision deficiency,” meaning that the people who suffer from this condition perceive colors differently than people with normal color vision. Only about one percent of all people with CVD are unable to perceive color. The most common form of CVD is when people have trouble discerning between certain red and green shades (Bailey). There are numerous problems that are caused by color vision deficiency. These problems can include everyday annoyances like being able to pick out a pair of matching socks in the morning as well as being able to discern different colors of vegetables. According to Tony Dykes, the CEO of EnChroma, only 11 out of America’s 50 states test for CVD in schoolchildren. “We routinely hear moving stories from color blind people about their struggles in school until they were finally diagnosed. Oftentimes, color blind kids are labeled as slow learners or suffer other humiliation” (“EnChroma and Clorox”). Another set of problems that people with CVD face occurs on the road. These individuals tend to have difficulty interpreting the red and green traffic lights, as well as other colored signs on the sides of the road. They could also be put into a dangerous position when it comes to red and green vehicles or equipment that appear suddenly,
as they will find it hard to see these objects due to their colors. These problems could prove to be hazardous and deadly (“Dangers and Limitations”).

People with CVD face difficulty when it comes to professional life. These people are restricted from having certain job opportunities, due to their lack of red and green color vision. Some of these jobs include pilots, electricians, road workers, as well as other high-risk professions (Mandal). There is also the issue of food. Particular foods pose a problem for people that suffer from CVD, as those who have certain food allergies will not be able to see the color of what they’re eating. For example, some people have an allergy to a red dye called Red 40, which is an ingredient in many soft drinks, such as Kool-Aid. They will also have a difficult time choosing fruits or vegetables that are ripe, as they cannot visually tell the difference (Hennessey). Having CVD could also limit a person from seeing a change in skin tone when outside. By the time someone with CVD is actually able to see the redness on their skin, they may have a severe sunburn. Although it might seem mild, this could cause pain, unwanted skin peeling, or even skin cancer (“Dangers and Limitations”).

**Description of Solution**

EnChroma lenses are engineered especially for people with CVD. The glasses work as a kind of filter that normalize how the eyes of a person with CVD perceive light. According to Don McPherson, founder of EnChroma:

“All people have three photopigments in the eye, also known as cones, which are sensitive to blue, green, and red” (qtd. in Zhou).
“Blue operates fairly independently, while the red and green cones, in most humans, overlap, affecting the perception of certain colors. For example, if 10 photons landed on the red cone and 100 landed on the green cone, the object viewed would appear more green. Whereas if an equal number of photons landed on the red and green cones, the color perceived would yellow. A problem arises when the red-green cones overlap too much, a condition that accounts for 99 percent of colorblindness cases. When this happens, in the previous scenario, instead of yellow, an individual would perceive little, if any color” (sic) (qtd. in Zhou).

“EnChroma’s technology works by placing a band of absorption on glasses that captures light, pushing the cones away from each other and reestablishing the normal distribution of photons on them” (qtd. in Zhou).

How EnChroma glasses apply to the problem:

- Seeing more of the color spectrum makes it possible for people with CVD to pick out clothes that match.
- The ability to tell the difference between red and green increases safety for drivers with CVD and everyone else on the road.
- EnChroma glasses can help students with CVD achieve improved academic performance. According to Optometry Times, “The EnChroma Cx indoor glasses enable students (and others) to more quickly and accurately identify and interpret important color-coded information at school and outside of class” (“EnChroma Releases Indoor Eyewear”).
- The glasses make it possible for people with CVD to identify foods by color. It also allows them to see the different food dies used in food products.
Because the glasses correct CVD, they should be considered corrective lenses. Since traditional corrective lenses are covered by insurance, EnChroma glasses should also be considered for coverage.

Research is being conducted to eventually make EnChroma glasses available to people with less common forms of CVD.

EnChroma glasses have many useful features:

- They are available in adult and pediatric sizes.
- There are lighter tinted versions for inside, as well as sunglasses for outside.
- They can be custom made for existing eyeglass prescriptions.
- There is a version that can be worn over a traditional pair of glasses.
- Models are available for sports and industrial safety usage.
- Contact lenses will be introduced in 2016.

How EnChroma Glasses Solve the Problem

How the Glasses Benefit Individuals with CVD

The glasses were originally designed to help protect surgeons’ eyes from lasers and help them distinguish different types of human tissue during surgery. According to Claire Martin, the glasses make objects appear “candy-colored.” (Martin). Dr. McPherson offered a pair of the glasses to a colorblind golfing companion back in 2002 and the companion noted he could see a set of orange cones, which he had previously been unable to see. If the technology worked back then in such a remarkable way, it can produce similar reactions today among the colorblind. The technology had immeasurable potential, even back then.

The glasses function by restoring balance between the signals in the eye’s photo pigments. By doing this, the red and green photo pigments are no longer overlapped. (“Company Backgrounder”). In order to see color well, the ratio of light hitting the photoreceptors must be precise. Otherwise, certain hues will be muddled and/or distorted. Bear in mind that persons with CVD have nothing wrong with the neural circuitry in their eyes—the color-perceiving photo pigments are just severely overlapped. EnChroma’s glasses rectify this by appropriating the red and green light into their respective receptors in the precise ratio, enabling the user to see colors accurately if they are colorblind, and more vividly if they are not. According to Seth Porges of Forbes.com, the glasses enable him to see objects as “slightly more vibrant versions of themselves” and see a brick wall that “always appeared brown” as a “bright red” (Porges).
Limitations

It should be noted that EnChroma’s glasses do not cure colorblindness. They are merely an instrument to rectify its effects when they are worn, much like how prescription eyeglasses rectify nearsightedness and other vision related problems. They only solve the problem if the user is willing to wear them at all times. This is something the user must take into consideration when making a purchase. Are they willing to wear a pair of glasses all the time, perhaps even two pairs given they already have prescription glasses? Also, EnChroma itself also states that seeing colors for the first time might be intimidating for some colorblind users, and this “learning curve” could be the straw that breaks the camel’s back. (“Company Backgrounder”). If the user is not willing to surpass these two hindrances, the usability of the product could be negated.

Why EnChroma is better than Competitors

EnChroma’s glasses are not clunky or unfashionable. They are available in a variety of styles, from lifestyle, to sports, to even kid’s frames. Also, the lenses are available in an industrial-strength grade. This package comes at a price though: $349.95 to $429.95 a pair. This is a hefty sum, one not all may be able to afford. But to those who can, it is certainly worth it. After all, no other solution exists that is as easy as putting on a pair of glasses, and EnChroma’s competitors lag behind in many respects. According to the company:

“Other companies do make glasses for the color blind, but their glasses use color-tinted lenses to distort colors and emphasize one color at the expense of another. They do not re-establish the correct balance between signals from the three photo pigments in the eye of the color deficient to enable them to truly perceive colors. These glasses also lack the depth of scientific research of EnChroma, and are mostly designed to help the color blind pass color blindness tests” (“Company Backgrounder”).

The Role of Insurance

It’s for these very reasons that EnChroma’s glasses must be taken into account by colorblind individuals, as well as by insurance companies. Some insurance providers already cover EnChroma lenses when they are combined with a traditional vision prescription (“Top Questions”). Without proper insurance, no one afflicted with CVD would have the security to advance with a purchase, rendering the dramatic effect this astounding and convenient technology has to offer innocuous. It would be a shame to let such advancements fall flat due to greed and stinginess.

Conclusion

Never before has there been such an effective solution for Color Vision Deficiency as EnChroma’s prescription glasses. With their newfound technology, individuals afflicted with red-green colorblindness will no longer have to suffer in silence in a dull existence. The ability of the lenses to rearrange the red and green light of the color spectrum and direct it in the correct ratios to their respective receptors allows people with red-green colorblindness to finally see the
colors that were previously shrouded in monotone, and even allows those without CVD to see colors more distinctly. The glasses come in adult and child’s frames and the lenses are even available in a heavy-duty grade. Without such a miracle product, persons with CVD would languish in an unnecessarily decreased quality of life. Despite EnChroma’s high prices, the technology can be approved by insurance companies to make it a more affordable, practical solution to CVD.

Even though the glasses do not cure color blindness, no other known solution exists that is as simple as donning a pair of glasses. EnChroma glasses can improve the lives of eighty percent of people that have CVD (Barnwell). Individuals with CVD will no longer have job and life opportunities withheld simply because they have a disability. After all, if nearsightedness can afford to be rectified with prescription lenses, then colorblindness should be given the same courtesy; they are both vision-related issues. The glasses were developed almost fifteen years ago to aid in surgical procedures, yet the technology found another admirable purpose. It has come a long way since its formative years. It would be a shame to allow Dr. McPherson’s work to be in vain. It is imperative these revolutionary new products get the green light from insurance companies that are able to make them more affordable to those who need them. The product’s potential is in their hands—if they could see it, they would believe it.
References


