United States Patent

[11] 3,586,423

[72] Inventor Harry I. Zeltzer
9 Rumford, Lexington, Mass. 02173

[21] Appl. No. 49,582
[22] Filed June 24, 1970
[45] Patented June 22, 1971
Continuation-in-part of application Ser. No. 857,543, Sept. 12, 1969, now abandoned, which is a continuation-in-part of application Ser. No. 462,068, June 7, 1965, now abandoned.

[54] METHOD OF IMPROVING COLOR DISCRIMINATION

3 Claims, No Drawings

[52] U.S. Cl. 351/39, 351/41, 351/44, 351/162
[51] Int. Cl. G02c 7/10, G02c 7/04, G02b 1/04
[50] Field of Search 351/26, 35, 39, 41, 44, 162, 163

[56] References Cited

FOREIGN PATENTS

617	1877	Great Britain	351/41
1,370,642	7/1964	France	351/162

Primary Examiner—David Schonberg
Assistant Examiner—John W. Leonard
Attorney—Joseph Zallen

ABSTRACT: A method and device are described for improving color discrimination in persons having a substantial amount of deficiency in their ability to discriminate between red and green colors, commonly referred to as "color blindness." The invention comprises applying to one eye only a corneal contact lens transmitting light substantially only in the red zone and leaving the other eye either naked or with its customary refractive correction, if any.

METHOD OF IMPROVING COLOR DISCRIMINATION

This is a continuation-in-part of my prior copending Pat. application, Ser. No. 857,543, filed Sept. 12, 1969 now abandoned, which in turn was a continuation-in-part of my then copending Pat. application, Ser. No. 462,068, filed June 7, 1965 and now abandoned.

BACKGROUND OF INVENTION

This invention relates to a method for improving color discrimination. In particular, it relates to a method and device for improving color discrimination in persons who are red-green color deficient.

It is generally believed that a person with normal color vision is able to discern an uninterrupted series of hues from red of about 760 millimicrons to violet of about 380 millimicrons with no black, grey or white areas. Persons with normal color vision clearly differentiate between the seven ordinary hues of red, orange, yellow, green, blue, indigo and violet.

However, according to some authorities, approximately 8 percent of males have a vision defect known as color discrimination deficiency or color blindness, a lack of a part of the neural apparatus necessary for normal color vision. Such neural defects are not completely understood. It is generally agreed that the most common type of color blindness is the inability to distinguish between red and green, known as red-green color blindness. A person having such color blindness has great difficulty in distinguishing brown from green and sees various shades of red (such as pink) as grey. Such red-green color blindness has been a great handicap to the persons involved, particularly with respect to their occupations, wherein color is a growing form of object identification. Further, colorblind persons, of whom there are about 8 million in the United States, are a hazard to themselves and to others, particularly in automobile driving and in hunting.

This problem of color discrimination deficiency has been reported and studied for many years. However, no one, to my knowledge, has ever suggested or proposed any method or device that would enable a person who had red-green color discrimination deficiency to improve it to any practical or substantial extent. Thus, although proposals have been made in the past to improve the ability of such persons to distinguish between red and green colored signal lights, no method or device has heretofore been proposed to improve the ability of such persons to discriminate between such colors in their everyday normal existence.

One object of the present invention is to provide a method and device of improving color discrimination among persons having color discrimination deficiency to such an extend that use of the method or device can extend for a full day, including nighttime without inhibiting the mobility of the person and without interfering with his normal everyday tasks.

Further objects and advantages of this present invention will be apparent from the description and claims which follow.

SUMMARY OF INVENTION

The invention comprises the use on one eye only of a corneal contact lens transmitting light substantially only in the red zone, with the other eye remaining naked or having its customary refractive correction, if any. The lens should be as thin as possible to avoid substantial loss of visual acuity. Although this single red corneal contact lens can be used with either the dominant or nondominant eye, I have noted that placing the lens on the nondominant eye appears to be more comfortable for the user.

When such a lens is worn in this fashion, a patient who could not hitherto pass the Ishihara test wherein red and green spot figures are used, was now able with my invention to pass this test and distinguish among brown, green, red and pink objects, which he had hitherto been unable to do. The lens can be worn either day or night or both with no special requirements except those of cleanliness and removal when sleeping normally associated with contact lenses. The use of this lens does not interfere with the person's mobility or his performance of ordinary functions such as walking, driving, writing, reading or working, whether under normal light or artificial light. The use of my invention does not interfere with binocular vision.

The single red corneal contact lens of this invention can be made so as to incorporate a desired refractive correction, or it can be used with a spectacle lens having the correction for that same eye or the refractive correction can be divided between the contact lens and the spectacle lens. The other eye, *not* covered with a red contact lens, can have required refractive correction in the form of a conventional contact lens or spectacle lens or both.

For example, a color deficient person who is without refractive error but requires reading glasses (spectacle lenses), as in presbyopia could use reading glasses in conjunction with the single red corneal contact lens of this invention. For color deficient persons with binocular refractive errors, the other eye can have a conventional corrective corneal contact lens with or without spectacles.

I have found by experimentation that thickness is a factor which limits the utility of a colored contact lens made in accordance with this invention. Thus, if the eye requires correction, the resultant contact lens may be so thick as to be overly dark for effective use. Accordingly, in such a case, a single red contact lens having no correction would be used in conjunction with a spectacle lens having the desired refractive correction. In this manner, the red contact lens may be kept thin enough to permit sufficient visual acuity. In general, the acuity should be at least 20/40 so that stereopsis is not lost. I have further found that the amount of light absorption by the contact lens of this invention also has an effect on its utility. Thus, if the lens absorbs more than approximately 86 percent of the light, that is to say has light transmission of less than approximately 14 percent, binocular vision is affected. Further, if the amount of light absorption is less than approximately 60 percent, that is to say the transmission is higher than about 40 percent, color discrimination ability begins to decrease. These percentages might be better understood if one notes that a plain contact lens has about 10 percent loss or 90 percent transmission, while a lightly tinted lens has about 30 percent absorption or 70 percent transmission.

Although the corneal contact lens of this invention can be made from a variety of materials, I prefer to use clear transparent plastic materials such as the polymethacrylate resin group. An example of such a resin which I have found useful is polymethylmethacrylate.

It is noted that the red contact lens of this invention is used monocularly. Thus, the "uncovered" eye receives a color-deficient image while the lens-covered eye receives an image which is differently shaded. The individual goes through a brief self-learning process in the true color. Thus, for example, the typical color discrimination deficient person cannot tell green from brown. From experiments with my patients, I have determined that with my invention the person sees green darker and brown lighter.

The "uncovered" eye is an important factor in this invention, since it receives certain colors correctly which are obscured in the eye covered with the single red contact lens. I have found that each eye compensates for the disability of the other by a process which is a form of "rectinal rival," a phenomenon of the visual mechanism.

Although the single red corneal contact lens of this invention can be used generally with persons deficient in color discrimination, there are certain contra-indicators. Thus, the lens of this invention should not be used where there is corneal pathology such as keratitis or where there are other diseases of the eye wherein the use of conventional corneal contact lenses are contra-indicated. Further, the single corneal contact lens of this invention would not be expected to improve color perception in persons who have amblyopia, strabismus or monocular vision.

SPECIFIC EXAMPLE OF INVENTION

In one example of my invention, a contact lens was used which was made of red polymethacrylate. The lens had a radius of 8.23 mm., a diameter of 9.0 mm. and a thickness of 0.23 mm. It had a peripheral bevel of 11.00/0.3, a secondary curve of 9.00/0.7 and an optic zone of 8.00. The lens transmitted substantially only in the red zone with practically no transmission below about 590 millimicrons, a peak at about 624 millimicrons, a range of about 590 to 700 millimicrons and an absorption of about 86 percent.

I fitted a patient with this single red contact lens in only one eye, namely his nondominant eye, leaving the dominant eye with no lens or uncovered. The patient indicated that he could now clearly study and decode color bands on resistors at a normal reading distance with average illumination and distinguish among red, brown and green. Prior to this time, although he had good visual acuity, he had always been colorblind and in particular completely unable to distinguish between red and green with, for example, brown looking like green and the various shades of red, as for example pink, appearing grey.

When the patient did not wear the lens, he reverted back to his original colorblind state but when he wore the lens, he always had this new ability to distinguish among red, brown and green. The lens did not in any way interfere with the patient's mobility and enabled him to continue to work at his job.

I wish to make it clear that while my experiments have shown that a single thin red colored corneal lens applied to one eye with the other eye uncovered will produce a practical, useful and substantial improvement in the ability of a colorblind person to improve his color discrimination, the use of two such lenses, one in each eye, does not produce this desired effect but instead distorts colors, such as orange.

I wish to also point out that a spectacle lens made of the same material as the corneal contact lens of this invention cannot be used as a substitute for the corneal contact lens, First, it would be exceedingly difficult to fabricate a spectacle lens of the same material and thickness because such a lens of, for example, 0.23 mm. thickness would be exceedingly fragile and difficult to form with accuracy. Even if such a spectacle lens were used in place of a corneal contact lens, it would provide significantly smaller improvement in color discrimination. When such a spectacle lens was made of the same material but of a minimum thickness to make it feasible, as for example, 0.5 mm., the images were blurred and the colors less distinguishable than without any lens. I have further found that when such spectacle lenses were used for both eyes, overall vision was seriously impaired and certain colors were distorted such as orange.

I claim:

1. A method for improving color discrimination in a person deficient in color discrimination comprising the step of applying to one eye only a thin corneal contact lens transmitting light substantially only in the red zone and having between approximately 14 and 40 percent light transmission and substantially no transmission below approximately 590 millimicrons, the other eye being left uncovered except for the optional use of a spectacle lens, conventional corneal contact lens, or a combination thereof to provide a desired refractive correction for that eye.

2. The method of claim 1 wherein a spectacle lens having a desired refractive correction is used in conjunction with said red contact lens.

3. The method of claim 1 wherein said red lens is made of a polymethacrylate resin and has a thickness of approximately 0.23 millimeters.