

## SOME EXPERIMENTS WITH GREEN SPECTACLES PRESCRIBED TO GLAUCOMATOUS PATIENTS\*

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In our preceding work<sup>†</sup> it was shown that the illumination of the one eye with green light resulted in the lowering of the intraocular pressure in the other eye, this effect being especially pronounced in glaucomatous eyes. It seemed natural, therefore, to test the use of green spectacles, as a means tending to reduce intraocular pressure. The present paper contains a description of the attempts made by us in this direction.

Experiments involving the use of green spectacles by glaucomatous patients were carried out on 19 subjects with various forms of the disease.

The period of observation was 12 to 15 days for in-patients (11 cases), and 30, 50, and more days for out-patients (8 cases).

### METHOD

The pressure was determined with the aid of the Schiøtz tonometer three times a day: at 7 a.m. when the patients were still in bed; at 1 p.m., and between 7 and 8 p.m., at the moments of a maximum or minimum intraocular pressure.

The patients were withheld from any medication during a whole day, or even two days, if the status of their eyes made it permissible. By the end of the second day, in most cases, the patient received green spectacles which he was asked to wear throughout the period of examination.

The spectacles were manufactured from green glass of a hue corresponding 511 m $\mu$ . and with daylight transparency equal to about 21 percent.

In certain cases the use of green specta-

cles was combined with a greatly reduced dose of pilocarpine. The combination of green glasses with the instillation of several drops of adrenalin (1:1,000) was also made to test Kravkov's statement that the instillation of adrenalin at this concentration may increase the eye's sensitivity to the green light.

The effect of the use of green spectacles under the given conditions was evaluated by us from the run of the diurnal curve of intraocular pressure.

### RESULTS

From an analysis of the curves obtained from testing patients, it may be seen that, notwithstanding the total suspension of pilocarpine medication, the intraocular pressure showed a pronounced tendency to decrease in patients wearing green spectacles; the range of fluctuations of intraocular pressure during the day was likewise found to decrease. (Degenerative alterations of these eyes were not advanced, nor was the level of tension excessively high.)

An appreciable effect was obtained when the use of green spectacles was combined with the administration of a very small dose of pilocarpine (0.5-percent solution twice a day).

In 20 of 25 diurnal curves, we were able to observe a clearly expressed decrease in intraocular pressure, as well as a reduction of the range in fluctuation, as compared to the records taken at the period when the administration of pilocarpine was entirely suspended. The decrease in tension was a fairly appreciable one—6.0 mm. Hg in 8 cases; 6.0 to 10 mm. Hg in 9 cases; 10 mm. Hg and more in 3 cases.

The decrease in intraocular pressure was much more striking, however, in certain

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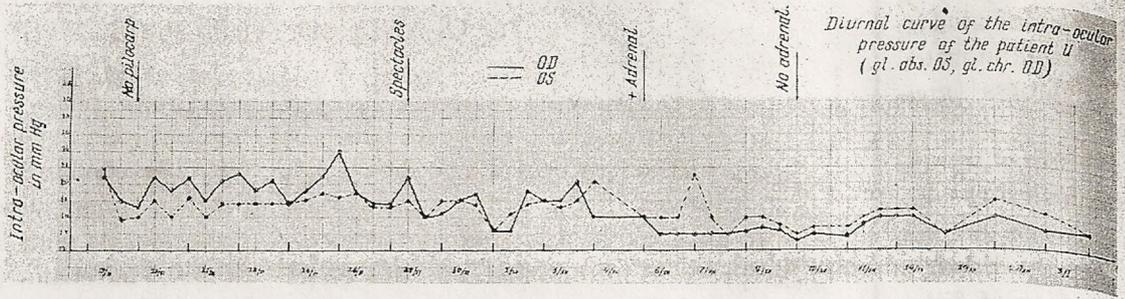


Fig. 1 (Zaretskaya). Case 1. Absolute glaucoma of the left eye; chronic glaucoma of the right eye.

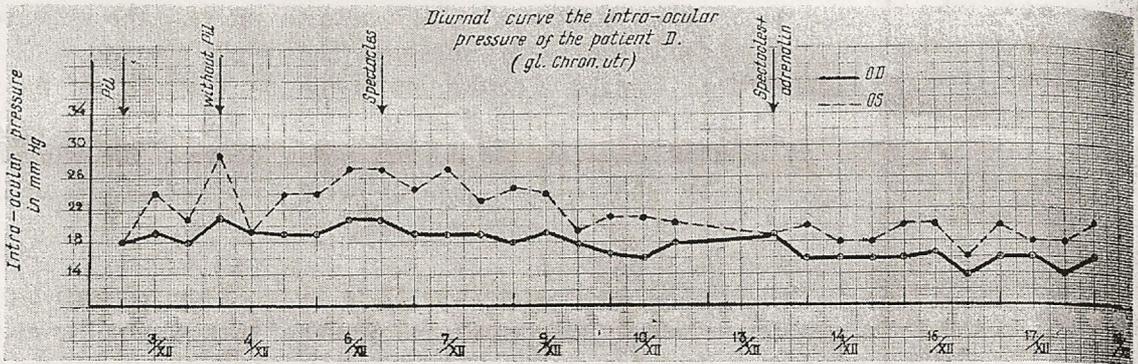


Fig. 2 (Zaretskaya). Case 2. Chronic glaucoma of both eyes.

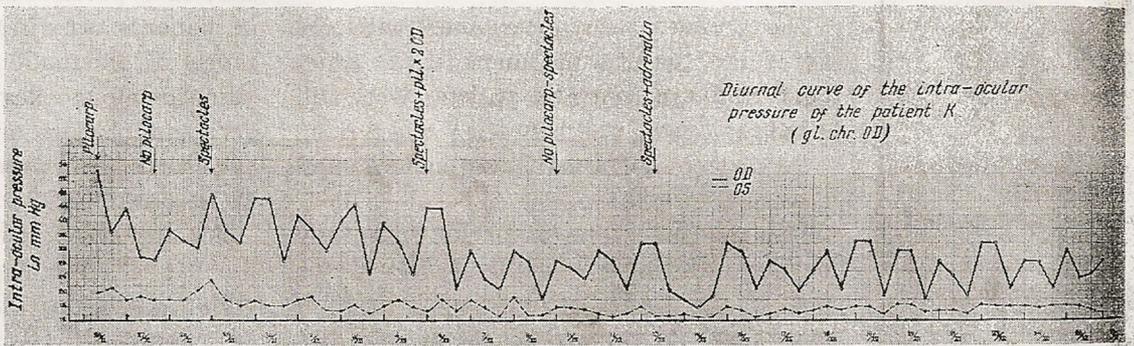


Fig. 3 (Zaretskaya). Case 3. Chronic inflammatory glaucoma of the right eye. The left eye was normal.

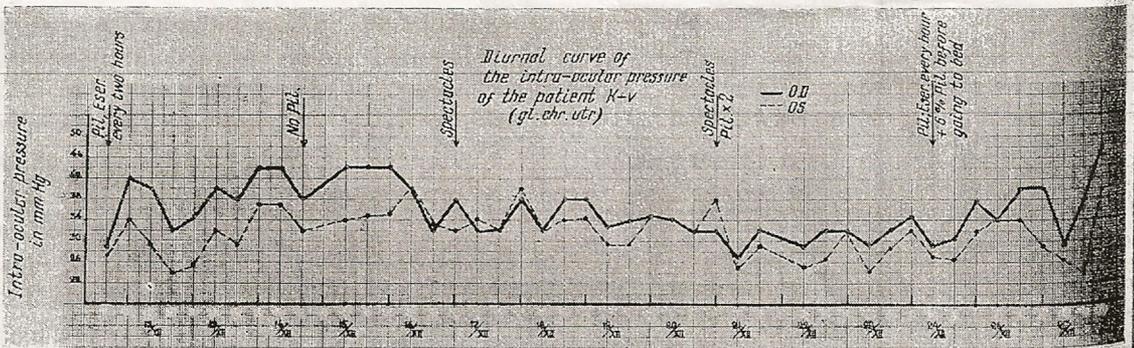


Fig. 4 (Zaretskaya). Case 4. Chronic glaucoma of both eyes.

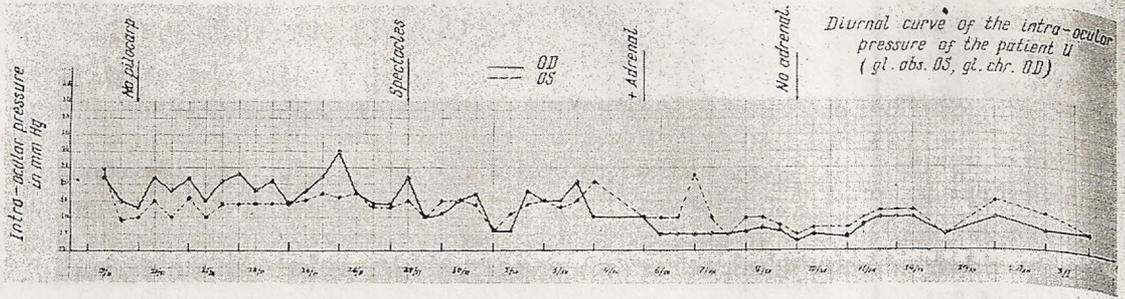


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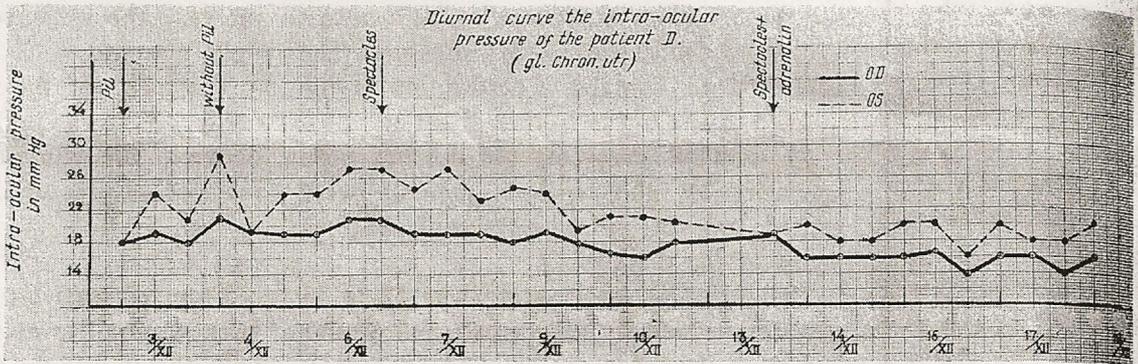


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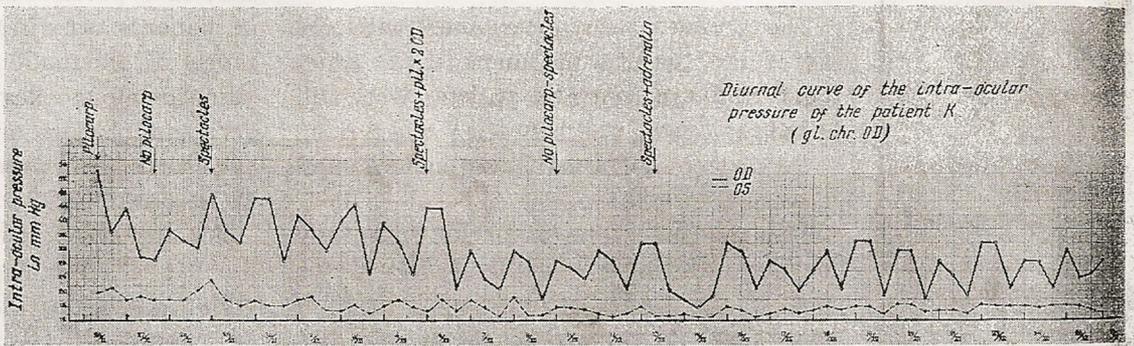


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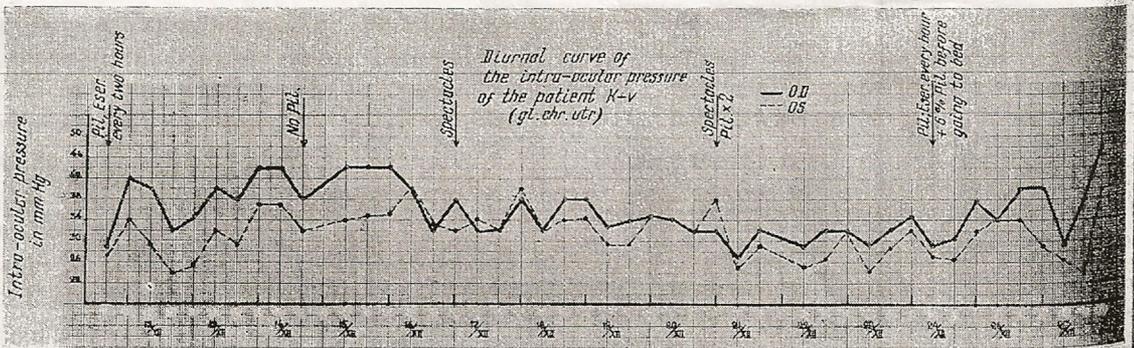


Fig. 4 (Zaretskaya). Case 4. Chronic glaucoma of both eyes.

use of green glasses. This was to be instilled twice a day into his right eye.

Under these conditions intraocular pressure showed a marked decrease, although on separate days of the period of examination its level attained 44 mm. Hg.

The best effect was attained, however, by substituting a 1:1,000 solution of adrenalin, twice a day, for the pilocarpine. The patient was observed for 11 days. Without entirely normalizing the tension, the combination of green spectacles with adrenalin prevented the maximum tension from exceeding 34 mm. during these days.

It should be pointed out in this place that, during the course of our experiment, we often observed that the instillation of pilocarpine at shorter intervals caused the intraocular pressure to persist at a higher level than when less frequent doses, or no pilocarpine at all, were given.

*Case 4.* (fig. 4). At this juncture it is of interest to cite the case of Ku., aged 65 years, who suffered from chronic glaucoma of the two eyes. The diurnal curve of this patient, after he had refused to wear green spectacles combined with small doses of pilocarpine, and after pilocarpine and eserine every hour had been prescribed as a pre-operational treatment, shows that there was a sharp increase in tension and that the level, in general, was much higher than during the preceding days. The range of fluctuation of tension, which had been 6.0 mm. or less, rose to 10 to 16 mm. during these days.

#### COMMENT

In addition to these successful results, cases were also encountered where the patients derived no benefit whatever from the use of green spectacles. Some even showed a slight increase in intraocular pressure, although this increase was observed in individual cases only, in patients whose intraocular pressure had for the most part been stabilized at a high level.

The questions arise: What is the clinical

value of our investigations? And what is their practical application?

The encouraging results of our experiments make us believe that the use of green spectacles may, in certain forms of glaucoma, prove a helpful therapeutic procedure, especially if prescribed along with small doses of adrenalin or pilocarpine.

#### DISCUSSION

The mechanism of the action of indirect stimuli upon the intraocular pressure is rather obscure and so is, although to a lesser degree, the mechanism responsible for the appearance of hypertension in the case of glaucoma.

Unquestionable, however, is the fact that green light, while acting upon the color receptor of our vision, produces a definite rearrangement in the vegetative nervous system, thus affecting also the neurovascular apparatus of the eye.

It may be assumed that the amounts of acetylcholine and sympathin in the eye are different, according to whether the eye is exposed to green or to red light: this may possibly be the cause of the opposite reaction of the intraocular pressure for the red or the green stimulus revealed by us.\*

#### CONCLUSIONS

1. Preliminary tests have shown that the use of green spectacles prescribed along with a total withdrawal of pilocarpine medication produces in glaucomatous patients a well-pronounced tendency toward a decrease in their intraocular pressure. The beneficial effect observed was at its maximum in patients showing a medium level of intraocular pressure accompanied with no sharply expressed disturbances in the function of the sight.

2. The intraocular pressure in glaucomatous patients has been found to be most reduced when the use of green spectacles

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cases in which the use of green spectacles was combined with small doses of adrenalin.

The 24-hour curves reproduced in Figures 1 to 4 were plotted for some of the patients investigated by us and may well illustrate all that has been said.

#### REPORT OF CASES

*Case 1* (fig. 1). The patient, a woman, 75 years of age, suffered from chronic glaucoma of the right eye and nearly absolute glaucoma of the left eye.

The eyes were quiet, corneas transparent, and the pupils were the size of a pinhead. The crystalline lens was sclerotic. Visual acuity of the right eye was 0.9; that of the left eye, light projection irregular. The visual field of the right eye showed a concentric contraction for the white, and a sharp contraction for the other colors. The fundus of the right eye showed a deep glaucomatous excavation of the papilla of the optic nerve; this was somewhat less profound in the left eye.

The tension as measured according to Sobansky in the arterial center of the retinas of the two eyes was 45 mm. Hg.

The patient has now been wearing her green spectacles for more than a year without receiving any supplementary medication.

No undesirable phenomena on the part of the patient's eyes have been recorded within this period during which she was under our continuous observation.

*Case 2* (fig. 2). The patient, a man, aged 61 years, had chronic glaucoma of both eyes. He complained of a mist swimming before the eyes, iridescent halos when looking at the lamp, reduced visual acuity, but no pain. He had been treated since 1937 with instillation of 1-percent pilocarpine solution, without feeling any better. At the first examination, the patient was much annoyed by the continuous dimness in both eyes.

The pupils were extremely narrow (mi-

osis medicam). Visual acuity was: R.E., 0.4 to 0.5, with a 0.5D. sph., 1.0; L.E., 0.4, with a 0.75D. sph., 1.0.

Green spectacles were prescribed and, as may be seen from Figure 2, the general level of the diurnal curve of tension for both eyes became lower. The patient enjoys his spectacles and feels more comfortable.

However, since the intraocular pressure in the left eye was occasionally found to fluctuate above the normal level, an attempt was made to combine the use of green spectacles with instillation of adrenalin solution (1:1,000). As seen from Figure 2, both the level of tension and its fluctuation range soon became quite normal.

*Case 3* (fig. 3). Patient K, a man, 62 years old, had chronic inflammatory glaucoma of the right eye. The left eye was normal. He had been ill since 1938 when he suddenly became aware of reduced visual acuity, of iridescent halos, and mist before his right eye.

Visual acuity was O.U., 0.02, without correction; O.U., 1.0, with correction.

The fundus of the right eye showed a glaucomatous excavation of the papilla of the optic nerve, although not sharply pronounced. The papilla was hyperemic, the veins extended.

The visual field was somewhat concentrically restricted for the white, and somewhat more for colored lights. The left eye was within the normal.

On November 29th the patient was asked to wear green spectacles. Diurnal curves were analyzed for five days. During this period, the intraocular pressure persistently showed a wide range of fluctuation, although at a somewhat lower level. The patient felt well, and he was less annoyed by the feeling of mist swimming before his eyes. He liked to wear his spectacles which make him feel more at rest; he was becoming much less irritable.

On December 6th, a 1-percent pilocarpine solution was prescribed in addition to the

was reinforced by the administration of small doses of adrenalin.

3. The mechanism of action of the green-light stimulus upon intraocular pressure still remains obscure. It is very probable however, that by acting upon the color receptor

of the human eye, the green light brings about a definite rearrangement in the autonomous nervous system and thus affects the neurovascular apparatus of the eye.

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## RUBEOSIS IRIDIS DIABETICA

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The association of new capillary formation on the iris with glaucoma in diabetic patients was first noticed by Salus<sup>1</sup> in 1928. He proposed the term rubeosis irides diabetica and called the associated glaucoma the true diabetic glaucoma in contradistinction to the usual primary glaucoma in the ordinary diabetic patient. Since his report of 3 cases, 37 more cases have appeared in the literature and have been reviewed by Fralick.<sup>2</sup> Two of the 5 cases reported by Fralick occurred in the absence of diabetes. The rarity of this condition is indicated in its absence in a series of 2002 diabetics in whom rubeosis was searched for, studied by Waite and others.<sup>3</sup>

The original description of Salus and his conclusions have been somewhat modified by the report of subsequent cases. As originally described, the surface of the iris is transformed by the appearance of new, light-red, capillary nets superimposed on an otherwise normal appearing iris tissue. These new vessels are in the region of the lesser circle of the iris, placed closely together and interlinked, and give this portion of the iris a reddish hue.

Other larger vessels run radially from the lesser circle toward the ciliary part where they disappear in the angle of the anterior chamber. The vessels never extend into the pupillary area itself.

The rubeosis is not related to the severity nor to the duration of the diabetes. Kurz<sup>4</sup>

presents one case in a man, aged 29 years, with diabetes of only three years' duration. The rapidity with which glaucoma follows the rubeosis is quite variable and may appear concomitantly or may be delayed as long as five years, as in one case of Salus. One third of the cases have an associated essential hypertension. Hemorrhagic and proliferating retinopathy is frequently associated.

Wegner<sup>5</sup> reports one case of rubeosis associated with diabetic retinopathy that was successfully operated on for cataract by intracapsular extraction. In view of the inevitable glaucoma in all other cases and the interval of five years between the appearance of rubeosis and the glaucoma in the case of Salus, the cataract extraction was probably followed by glaucoma after a long interval.

Glaucoma is a sequel to the capillary formation and invariably appears if the cases are followed long enough. The glaucoma is associated with hemorrhage in the anterior chamber and does not respond to miotics; surgical intervention is always followed by disastrous consequences.

Gonioscopic examination of the angle was described by Kurz<sup>4</sup> who found large radially running vessels breaking up into many branches connecting directly with Schlemm's canal. The angle at first was bridged by numerous synechias between which ran many fine vessels; the angle was almost completely obliterated as the pathologic process advanced. Schlemm's canal was filled with