Corneal sensitivity in people with the same and with different iris color. MICHEL MILLODOT.

Corneal touch thresholds were determined for both eyes of 15 people with different colored irides (a condition known as heterochromia) and of 25 people with similar colored irides. It was found that corneal sensitivity is not significantly different in both eyes of either group. Therefore it is suggested that the fact previously demonstrated that corneal sensitivity is related to iris color is not of corneal origin.

In a recent study Millodot demonstrated a relationship between the color of the eyes of a subject and his corneal sensitivity, which on average is more sensitive with blue eyes than with brown eyes. It is not known, though, whether this phenomenon is to be attributed to some characteristics of the cornea (e.g., differences in thickness or nerve density) or to some CNS factors. The purpose of this experiment was to measure corneal sensitivity in people with different iris color to further elucidate the problem. Measurements were also made on people with the same iris color as controls.

Methods. The cornea was stimulated by the Cochet-Bonnet esthesiometer\(^2\) based on the instrument designed by Boberg-Ans.\(^3\) The instrument consists of a nylon monofilament of 0.12 mm. diameter which can produce pressures ranging from 11 to 200 mg./0.0113 mm.\(^2\). The esthesiometer was mounted in a holder such that it could be moved in \(x\), \(y\), and \(z\) axes by means of three knobs. Thus it was possible to achieve reliability in stimulation of the same corneal point, a steady speed of application, and a perpendicular corneal contact. A corneal point near the lower limbus was stimulated and the slightest bend of the nylon wire visible through a magnifier was defined as corneal contact. The peripheral corneal point was chosen because the touch threshold measured there is usually unaffected by apprehension factors.\(^4\)

Measurements of corneal touch thresholds were made subjectively.\(^5\) The experimenter began with stimulation of the cornea with the lowest pressure and continued in an ascending fashion. At each predetermined length of the nylon probe (with

\[\begin{array}{|c|c|c|c|}
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\text{Right CTT (mg/mm}^2\text{)} & 10 & 20 & 30 \\
\hline
\text{Left CTT (mg/mm}^2\text{)} & 10 & 20 & 30 \\
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\end{array}\]

Fig. 1. CTT’s for right and left eyes of 25 persons with the same iris color (closed circles) and 15 persons with different iris color (crosses).
increments equal to 0.5 cm.) four to six contacts were made with at least one blank to test the subject's reliability. The subject indicated when he felt the stimulation by pressing a bell. From these measurements the corneal touch threshold was defined as the length of the monofilament at which the subject responded for 50 percent of the number of stimulations. This length was converted into pressure with a previously calibrated curve for the instrument. Measurements were done on the right eye and then the left eye and the sequence repeated in a reverse order.

The subjects were divided into two groups. The control group made up of 25 people (14 females, 11 males) between 22 and 37 years of age and having the same iris color. The experimental group consisted of 15 people (10 females, 5 males) between 15 and 79 years of age and having different iris color. (Because of the rarity of this condition they were found by advertising in the newspapers.) One subject with different iris color had vitiligo, a condition characterized by the appearance of spreading white blotches in the skin. All subjects with different iris color claimed to have had the peculiarity since birth or soon thereafter and four of them reported that one grandparent had had the same condition.

**Results.** The corneal touch thresholds (CTT) of all right and left eyes of the control group are shown in Fig. 1 by the full circles. The correlation coefficient between the two eyes is +0.97. The mean (and standard deviation) CTT of all right eyes is equal to 23.84 mg. per square millimeter (11.14) and of all left eyes 23.70 mg. per square millimeter (11.53). This difference is not statistically significant according to the paired-samples t test \((p > 0.3)\). The spread of the results confirm previous measurements.\(^5\) \(^6\) It is mainly attributable to differences in iris color\(^1\) as well as to inherent biological differences.

The CTT of all right and left eyes of the people with different iris color are also illustrated in Fig. 1. The correlation coefficient between the two eyes is +0.99. The mean (and standard deviation) CTT of all right eyes is equal to 30.93 mg. per square millimeter (15.80) and of all left eyes 31.07 mg. per square millimeter (16.94). This difference is not statistically significant with the paired-samples t test \((p > 0.5)\).

The comparison between the control group of 25 young subjects can only be made with the 13 young subjects (age 16 to 46) with different iris color, since age affects corneal sensitivity.\(^3\) It is found that the mean CTT of all eyes of the control group is not significantly different by the t test \((p > 0.2)\) than the mean of all eyes of the 13 experimental subjects.

**Discussion.** Although the comparison between the corneal sensitivity of the two eyes does not seem to have been investigated systematically in man, it was tested in guinea pigs. Strughold\(^7\) found no significant difference between the two eyes of 10 animals. On the other hand, corneal thickness has been shown to be the same\(^8\) in people with the same iris color. The fact that corneal sensitivity and thickness is the same in both eyes (provided they are both healthy) furnishes evidence of equal nerve density in both eyes.

The fact that corneal sensitivity was found not to be significantly different in all the people with different iris color leads one to assume that nerve density must be the same in the two eyes of this group as well. Moreover, this result suggests that the differences found among people of varying iris color\(^1\) are not due to some inherent differences in their corneas but to some higher mechanism of the sensory system subserving the sensitivity of the cornea.

Another question concerns the possible predominance of one eye over the other in people with two different iris colors. Is the binocular corneal sensitivity that of a blue-eyed person or that of a brown-eyed person? When the present results on people with different iris color are compared to those obtained previously on people with the same iris color,\(^1\) the answer is equivocal. Seven of the subjects had corneal sensitivity somewhat analogous to that of a dark brown-eyed Caucasian, three to that of a blue-eyed person, and five to that of people with intermediate eye color.

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**REFERENCES**