

LAGOPHTHALMOS DURING SLEEP*†

BY

F. O. MUELLER

From the MRC Ophthalmic Research Unit, Westminster Hospital, London

THE involuntary closure of the eye-lids occurs invariably with the onset of, and is maintained during, sleep. This protects the exposed surface of the eyeball from mechanical damage and reduces the intensity of light stimuli. The degree of rotation of the eyes behind their closed lids varies among individuals and there is no position which can be called "natural" for the eyes during sleep (Adler, 1965).

Lagophthalmos during sleep has been described as a hereditary congenital abnormality in a mother and her son; voluntary lid movements were unimpaired but during sleep the eyes remained open and staring straight ahead (Duke-Elder, 1964).

Some eyes of patients examined in Addis Ababa for full-thickness keratoplasty showed opacities which extended over the lower or middle one-third of their corneae and recalled the opacities following exposure-keratitis (Fig. 1, opposite). Accidental discovery of corneal exposure during sleep in a child aged 3 led to the following observations and a possible explanation for the development of such corneal scars.

Observations

Children of the Amharic race are generally slender in build; they have large eyes and the opened lids rise well above the limbus. Because of their children's large eyes parents believe it natural that some of them sleep with their eyes open, although they cannot explain why several adults with normal corneal exposure also show the same unusual position during sleep (Figs 2 and 3, opposite).

At the onset of sleep the lids are closed and the position of the globes—as judged by the position of the corneae behind the closed lids—is generally elevated. With deep sleep, however, the upper lids of both eyes retract simultaneously and the interpalpebral fissure is opened by about 3 to 4 mm. The eyeballs are in the primary position or are either slightly divergent or convergent; a section of the lower or middle one-third of the corneae is thus exposed with the pupils partially dilated. This position of lids and eyes is maintained unless the child is disturbed, but even then the closed lids and elevated globes soon return to the above-described position. A torchlight directed for less than a second on to one partially-open eye does not affect the position of either lids or eyeballs, but prolonged exposure to light or an electronic flash brings about lid-closure and eye-elevation, although the non-irritated side

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† Address for reprints: Eye Department, Westminster Hospital, London, S.W.1.

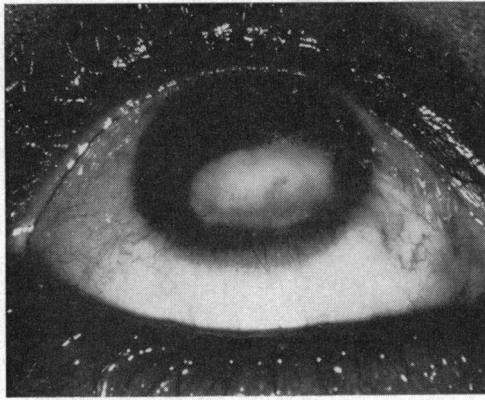


FIG. 1.—Oval-shaped opacity over lower third of cornea.

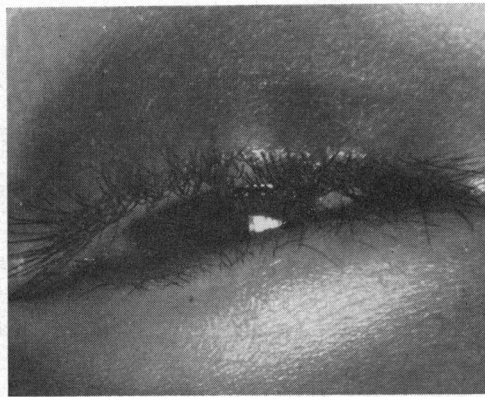


FIG. 2.—Child aged 3 photographed during deep sleep.



FIG. 3.—Adult aged 45 photographed during deep sleep.

sometimes remains undisturbed. After closure and when the child remains quiet, the eyes open again. The open lids of one child observed for several nights did not alter their level; the corneae remained moist and tears did not collect along the lower lid margins.

Children and adults in whom the condition was observed showed normal voluntary lid movements, the corneae were clear, and the visual acuities were found to be normal. Between the ages of 4 and 8 years the unusual lid-position changes to normal closure during sleep. Adults who retained their lagophthalmos during deep sleep were unable to state whether the condition had been present during their childhood.

Discussion

The cornea is exposed to the air between blinking, and Wolff (1946) described the oily layer upon the tear film as the protection which prevents undue evaporation and drying of the cornea. Mishima and Maurice (1961) confirmed the clinical observation in animal experiments. They could show that in a normal eye water evaporation from the tear-film is minimal even when the lids are kept open for very long periods. The secretion of the Meibomian glands spreads readily over the tear-film and constitutes the oily protective layer; the destruction of the Meibomian glands causes disappearance of the oily film, which is followed by rapid water evaporation from the cornea and corneal dryness. Their investigations explain why the exposed corneae of children and adults observed in Addis Ababa do not dry out and suggest a possible aetiology for the horizontal corneal scars found in some of our patients. In all these

cases with typical corneal opacities the tarsal conjunctiva was scarred, mainly by trachoma and secondary infection, and in two of the twenty patients the tarsal plates

were deformed. A possible lack of Meibomian secretion and absence of the oily layer in patients asleep with exposed corneae could have induced corneal scarring. The relevant history, however, could not be obtained.

The aetiology of the unusual position of the lids during sleep remains obscure, but it probably represents an inherited abnormality within the Amharic race.

REFERENCES

- ADLER, F. H. (1965). "Physiology of the Eye", 4th ed., p. 496. Mosby, St. Louis.
DUKE-ELDER, S. (1964). "System of Ophthalmology", vol. 3, part 2, p. 887. Kimpton, London.
MISHIMA, S., and MAURICE, D. M. (1961). *Exp. Eye Res.*, **1**, 46.
WOLFF, E. (1946). *Trans. ophthal. Soc. U.K.*, **66**, 291.