

# EXOPHTHALMOS: THE MECHANISM OF ITS PRODUCTION IN EXOPHTHALMIC GOITRE

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THE exact cause of exophthalmos in exophthalmic goitre is not known. The purpose of this paper is to call attention to an interesting phenomenon of the eyes observed in a case of exophthalmic goitre and to discuss the possible relationship of this phenomenon to the production of exophthalmos. A number of theories have been advanced to explain the occurrence of exophthalmos in exophthalmic goitre. The anterior displacement of the eyeball has been ascribed to an increase in the retrobulbar tissues, to a weakening of the muscles which retain the bulb in the orbit, and to the increased tonicity of muscles which draw the eyeball anteriorly. Jeandrassick and Mendel described an abnormal deposit of retrobulbar fat. Muller thought there was an increase in the retrobulbar tissues due to a serous infiltration. Graefe, Sattler, and McKenzie believed that the increase in retrobulbar tissues was due to venous congestion. Atony of the muscles which retain the globe within the orbit has been thought to be the cause of exophthalmos by Traube, Recklinghausen, Bristowe, and Dalrymple. The fact that the protrusion of the eyeballs in exophthalmic goitre might be due to an increased muscle tonicity has been advocated by Landstrom. Landstrom demonstrated the existence of unstriped muscle fibres arising in the orbital septum and inserting on the equator of the globe so as to form a band about the eyeball.

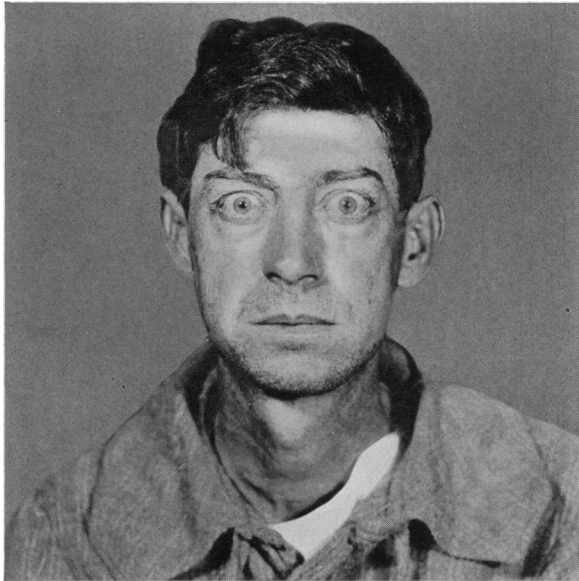


FIG. 1.—Photograph showing the appearance of the eyes when viewed from the front.

The relationship existing between the increase in the size of the palpebral fissure and an existing exophthalmos has not been made clear. The statement has been made that the increased width of the palpebral fissure makes

exophthalmos more apparent than real, but it is generally accepted at the present time that there is an actual dislocation anteriorly of the globes in exophthalmic goitre. The fact that an increase in the width of the palpebral fissure might be a factor in the mechanism of the displacement of the eyeballs anteriorly in the exophthalmos of exophthalmic goitre has not been emphasized.

The observations to be described were made upon a white male patient, thirty-three years of age, who was admitted to the Vanderbilt Hospital on



FIG. 2.—Lateral view showing the position of the globe with eyelids open. Note the position of the cornea relative to the bridge of the nose. See Fig. 3.

January 5, 1926. This patient presented the cardinal signs and symptoms of exophthalmic goitre. The disease was of ten years' duration. The amount of exophthalmos which was present is illustrated in Fig. 1.

On examination of the patient it was noted that there was little or no exophthalmos when the eyelids were closed. Furthermore, if one of the eyes was carefully observed in profile, it was apparent that the eyeball receded into the orbit during the act of closure of the lids. It was also

interesting to note the fact that the greatest amount of recession of the eyeball into the orbit occurred before the lids were completely closed. If the patient was observed in profile with the eyelids closed to such a point as to produce approximately the normal width of the palpebral fissure, the recession of the eyeball into the orbit was sufficiently great as to leave little or no evidence of exophthalmos.

In order to study this phenomenon more accurately a kinetographic film was prepared of a profile view of one of the patient's eyes during the acts of opening and closing the lids. The study of this film revealed the striking amount of anterior posterior movement of the eyeball accompanying opening and closing of the lids. It also made it clear that the most of the movement of the globe occurred during the excursions of the eyelids between the points which marked the normal width of the palpebral fissure and its extreme width. The displacement of the globe anteriorly which accompanied the opening of the eyelids was particularly striking and suggestive of the important function of the lids in the retention of the eyeball in the orbit. As the

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palpebral fissure was enlarged by the separation of the eyelids there was very little anterior motion of the globe until the palpebral fissure enlarged beyond its normal width, after which the eyeball moved forward rapidly. The eyeball thus appeared to be extruded through the enlarged palpebral aperture. The relationship existing between the position of the eyeball in the orbit and the width of the palpebral fissure is illustrated in Figs. 2 and 3. These photographs were made without movement of the patient's head or the camera.

All of the theories which have been heretofore advanced to explain exophthalmos have assumed that the dislocation of the eyeballs anteriorly is due to some force acting directly on the globe and that widening of the palpebral fissure is secondary to the exophthalmos. The study of the relationship of the size of the palpebral fissure to the position of the eyeball in the orbit in the instance described in this paper is suggestive of the fact that the position of the eyeball was largely dependent on the restraining force of the lids. The palpebral fissure can be compared with an incision. All tissues in the



FIG. 3.—Lateral view showing the eyelids closed. Note the position of the anterior surface of the upper eyelids relative to the bridge of the nose. The camera and the subject are in the same relative position as in Fig. 2. The amount of recession of the globe is apparent.

body exist in a state of constant tension. If the skin is incised, the wound gapes and the underlying tissues protrude. If the capsule of a gland is incised the glandular tissue bulges through the incision. Furthermore, if there is no co-existing pathological process which changes the nature of the tissue it will presumably subsequently resume its normal state of tension. With this idea in mind the relationship between the width of the palpebral fissure and the position of the eyeball in the orbit becomes apparent. The retrobulbar tissues must exist in a certain state of tension. The rigid walls of the orbit result in this expansile force being balanced by the eyeball which must in turn be partially restrained from movement anteriorly by the eyelids. If the palpebral fissure is enlarged, the restraining power of the lids is of necessity reduced in geometrical ratio because of the spherical shape of the eyeball. If these facts are placed in relation with the enlarged palpebral fissure and the infrequent closure of the lids which occurs in exophthalmic goitre, their importance in explaining exophthalmos becomes obvious.

Furthermore, it is obvious that this explanation of exophthalmos would of necessity assume an increase in retrobulbar tissue to occupy the space and maintain the tissue tension resulting from anterior movement of the eyeball. With this explanation increase in retrobulbar tissue is due to the anterior dislocation of the eyeball rather than the cause of it.

Müller described unstriped muscle in the upper lid between the levator palpebral superioris and the tarsal cartilage, and in the lower lid between the conjunctival fornix and the tarsal cartilage. It is possible that the contraction of these muscle bands, which are supplied by the sympathetic nerves, may produce widening of the palpebral fissure. It has been shown that changes occur in the cervical sympathetic ganglia in exophthalmic goitre.

It was thought that the exophthalmos might be benefited by diminishing the size of the palpebral aperture and maintaining the reduced size by some appliance. This was accomplished by the application of a colloidin dressing to upper lids with the eyes closed. With the upper lids thus stiffened, the patient was unable to open his eyes widely. The result obtained by the use of this simple procedure was such that its further trial is indicated.

If further observations prove that diminution of the restraining force of the lids is an important factor in the production of exophthalmos, a rational basis for therapeutic measures will have been established.

*Conclusion.*—Diminution of the effective restraining action of the eyelids is an important factor in the mechanism of the production of exophthalmos.