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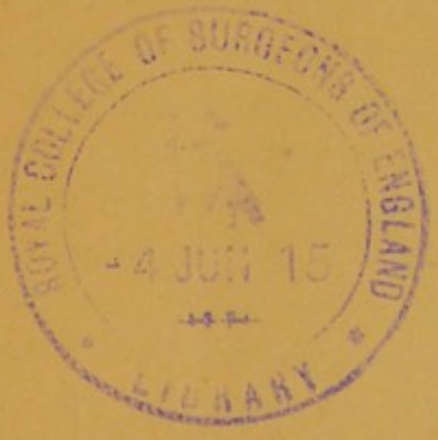

PRISM EXERCISES — THEIR INDICATIONS AND TECHNIQUE.

By ALEXANDER DUANE, M.D.,
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In offering these remarks on prism exercises I intend simply to give a few conclusions that I have reached as a result of my own experience. These conclusions, it must be added, I regard as tentative only. Premising this, I will state first the methods that I have been led to adopt in making prism exercises, and second, the indications that, in my experience, such exercises may be expected to fulfill.

METHODS EMPLOYED.

I regularly employ four exercises:

Exercise A. Distance exercise with prisms, base out. — The patient looks at an object — either a small light or the bull's-eye of a one-foot target — on the other side of the room, and holds a square prism of, say 10°, base out, before the left eye. The moment he unites the double images produced by the prism he drops the latter and puts up a stronger prism, say one of 15°, before the right eye. This in turn he drops as soon as the double images are united, and substitutes for it a prism of 20°, held base out before the left eye. When he can overcome the 20° readily, he tries in succession the following combination:

15° before one eye and 10° before the other, producing an absolute converging effect of 13.5° of arc.

20° before one eye and 10° before the other, producing an effect of 16.5°.

20° before one eye and 15° before the other, producing an effect of 19.5°.

20° before one eye and 15°+10° before the other, producing an effect of 25°.

20°+15°+10° before one eye, producing an effect of 29°.

A progressive increase in the effect may be produced not only in the way above indicated, *i. e.,* by using different combinations of two or three prisms, but also by using a single prism and *rotating* it on a vertical axis either forward or back. The deflecting power of a prism can be almost doubled in this way, and, moreover, can be increased gradually, so that with two or three prisms thus rotated all degrees of deflection may be produced from 5° to 50° of arc.

If with any given combination the diplopia cannot at once be overcome, resort may be had to Gould's expedient of approximating the test-object until seen single, and then gradually carrying it off to the proper distance, the patient all the time keeping his eyes on it and endeavoring to maintain fusion. Or, the same thing may be effected if, as suggested by Stevens, the patient looks through the prism at a finger held close to his nose, and keeps his eyes fixed sharply on the finger as it is slowly carried out toward the distant object.

Exercise B. Exercise with prisms, base out, at near points. — Exercise at near points with prisms, base out, is done in the same way as for distance, except that the test-object is either a minute electric light or a fine dot[1] in the center of a circular card five inches in diameter. The card is held at the reading distance, and is shifted back and forth, special efforts being made to maintain fusion while the card is being carried *toward* the eyes.

Exercise C. Exercise at near points with prisms, base in. — As is well known, the ability to overcome prisms, base in, when the eyes are directed at a distant object, cannot usually be increased by practice. This does not hold, however, for such prisms when used at near points.

The test-object here is the same as that used in Exercise B, *i. e.,* is either a minute electric light or a dot on a card. The patient, holding a 12° or 15° prism before either eye, brings the object up toward him until it appears single, then carries it steadily off until he can no longer fuse the double images. This is done three or four times in succession, the attempt always being

[1] If there is hyperphoria, the dot may conveniently be replaced by a short vertical ine.

made to carry the object as far off as possible and still maintain fusion.

Exercise D. Exercise in converging on a pencil. — This consists simply in carrying a pencil (or in amblyopic patients a minute electric light) from arm's-length in toward the nose until the object appears double. This is repeated three or four times, the attempt always being to bring the object closer than before and still maintain fusion, — in other words, to approximate the convergence near-point.

PRECAUTIONS TO BE OBSERVED IN DOING THE EXERCISES.

1. The *test-object* should be well defined and not such as to be confused with its surroundings. It should be just large enough for the patient to see distinctly at the distance employed, and yet so small that he has to fix sharply in order thus to see it.

2. The patient should wear the *glass correcting his refractive error* when doing the exercises, and, if presbyopic, he ought to wear his reading-glasses when doing Exercises B, C, and D.

3. Attention should be paid to the *effect of the exercises on the accommodation.* The use of prisms, base out, tends to cause a spasm of accommodation, the amount of which can be inferred from the degree of blurring of sight produced when the patient looks through the prisms at a test-card, and from the strength of the concave glass that is required to clear his vision.

In some cases possibly this spasm of accommodation may keep up for a long time after each practice, and may even be permanent. In most cases it should be possible to obviate any such tendency to undue spasm by using diverging exercises (Exercise C) directly after Exercises A and B. If this does not suffice, or if for any reason it seems improper to use Exercise C, the desired relaxation of the accommodation can be effected by using the test-types as an object of fixation when doing Exercise A. The patient, looking at the letters through the prisms, gradually learns to relax his accommodation, so that his vision slowly clears from 20/200 to perhaps 20/40, or better, even while he is still maintaining the convergence that the prisms impose. With Exercise

B (prism-convergence at near points) a similar relaxation of the accommodation can be effected by adding a +2 or +3 D to the patient's distance glass, and with Exercise D (convergence on a pencil) by adding a +10D. This seems to be rarely necessary.

USES OF PRISM EXERCISES.

The uses of prism exercises, I think, may be stated as follows:

I. *To rectify muscular anomalies.* — Prism exercises often relieve a muscular anomaly either because they actually reduce its amount or, perhaps more frequently, because they give the patient ability to overcome the anomaly with greater ease, so that he can readily maintain binocular fixation in spite of it.

1. *Exophoria.* — In this condition I use all four exercises, A, B, C, and D, combining and varying them according to the variety of exophoria present.

Thus in a pure *convergence-insufficiency,* marked by considerable exophoria for near, with recession of the convergence near-point, but with little or no exophoria for distance and a prism-divergence of not over 8°, I restrict or altogether dispense with exercise with prisms at a distance (Exercise A), but push the convergence exercises at near-points (Exercises B and D). At the same time it is often necessary, particularly if the diverging power is low (less than 5°) to add diverging exercises (Exercise C) and even push them, in case observation shows that the convergence practice is causing an homonymous diplopia for distance or is producing a spasm of accommodation. In these cases we have to watch closely the results of the practice, and push sometimes one exercise, sometimes the other, as the occasion seems to demand.

On the other hand, in a *divergence-excess,* characterized by marked exophoria for distance with a prism-divergence of 10° or considerably more, we should push the distance practice with converging prisms (Exercise A). If, as is often the case in this variety of exophoria, there is little deviation for near, and the convergence near-point is about normal, we would restrict or even altogether dispense with convergence exercises at near (Ex-

ercises B and D). Exercise C (practice with prisms, base in) would here be obviously improper.

In cases of *combined divergence-excess and convergence insufficiency,* with marked exophoria for both distance and near, we would use all four exercises, varying them according as one or the other element (divergence-excess, convergence-insufficiency) predominates.

Each case has to be judged by itself, and the amount of exercise prescribed determined by the patient's ability and endurance. As a rule, I have the patient practice at home either three or four times a day, for three or four minutes at a time, each practice consisting of Exercises A, B, C, and D, done in succession, and in the order given, and very precise directions being laid down as to the amount of work to be done in each exercise. These directions have to be modified from time to time, as the muscular condition changes. Hence, I re-examine the patients once or twice a week, determining the amount of deviation for distance and near and the converging and diverging power, and from these data judge how the case is progressing and how the exercise should be varied.

At no time should any exercise be pushed to the point where it produces more than slight or temporary fatigue.

As a general thing, I think convergence exercises do very little good, unless the patient works up to a prism-convergence of at least 50° for distance and near and reduces his convergence near-point to less than two inches. This he can usually do in two or three weeks.

2. *Esophoria.* — Here the use of diverging prisms at near points (Exercise C) is indicated. This is done some four times a day for a few minutes at a time. I have thought this exercise especially useful in cases of *convergence-excess,* and particularly in the temporary esophoria produced in myopes who for the first time are wearing concave glasses for near. Theoretically, it should also help in divergence-insufficiency, or the condition characterized by marked esophoria for distance, with low or negative diverging power and with little or no esophoria for near.

I have not had enough experience with it in these cases to vouch for its efficacy.

II. *To modify the effect of operations.* — The effect of a tenotomy can be very considerably modified by prism-exercises, particularly if these are initiated during the first few days after the operation.

Here considerable care has to be observed, for it is quite possible to produce an unpleasant over-effect by excessive exercise. The exercise in this case, at least during the first week or two, ought to be conducted mainly by the surgeon himself, being altered from day to day, and one exercise being balanced against the other as the case demands.

I am sure that I have prevented the development of a divergence after tenotomy of the interni, by exercise with prisms, base out, and the development of an undue convergence after tenotomy of the externi, by exercise with prisms, base in, and in other cases still have secured closer approximation to an ideal result by means of prism-exercise.

III. *To modify accommodative states.* — Exercise with prisms, base out, may be used to stimulate a subnormal accomodation, and exercise with prisms, base in, to relieve a spasm of accommodation. These exercises, particularly the latter, constitute, I believe, a very useful application of prisms.