Date: July 11, 1957

To: A. J. Torda

From: D. B. Whitney

Subject: Centering Standards

You have asked for a write-up on the reasons behind our new centering standards. These are as follows:

One definition of the optical center of a lens is that point on the lens where there is no prism. In ophthalmic application, we generally want the lenses to be positioned on the patient's face such that he looks through the optical center of the lens for straight ahead vision. It might be more correct to say that we want to be sure that if one eye is looking through the optical center, the other eye is also. This means that when one eye is looking through a point of zero prism, the other eye will be at a point of zero prism also and no prismatic imbalance will be introduced. Under such conditions, if we consider the prescription to be similar in both eyes, then as the eyes are rotated, prism is introduced, but it is of equal magnitude and in the same direction for both eyes so again there is no imbalance.

There are other reasons why we want to have the lenses properly centered on the patient's face, one of them being that such positioning has been assumed in the design of corrected curve lenses; therefore, marginal error will not be properly compensated if the lenses are incorrectly positioned. There are still others, but by far the important consideration is that of prism.

Because prism is what we are trying to control when we take pains to properly center lenses in a prescription, it is reasonable that our centering tolerances, even on finished uncut lenses, should be based on prismatic considerations. The tolerances in common use by most manufacturers up to this time have not been based on prism, but rather have been concerned with the location of the optical center with respect to the geometrical center. A larger tolerance has been allowed on low powered lenses than high powered ones because it was found that it was needed in manufacturing. While it is possible, and not too difficult, to hold the optical center of a relatively high powered lens to within 2 mm. Of the geometrical center, it is next to impossible to do this in a lens having only a 1/8 or ¼ diopter of power.

In the case of a plano lens it has been standard practice to use a tolerance in terms of prism, because it was recognized that even minute amounts of prism can throw the optical center off the lens entirely. This was sensible, but what was not recognized is the fact that this is even more true on a -0.12 diopter lens than it is on a plano! This is because the front and rear curves are more nearly concentric for this power, and from the geometry of this situation it is easily seen that when the curves are concentric, any amount of prism at all will throw the optical center a tremendous distance. The facts are that, because a -0.12 diopter lens is more critical in this respect, a -0.25 diopter lens is about equally as critical as a plano.

Recognizing that our previous centering standards for finished uncut lenses were not sensible in light of the discussion above, I presented the facts to the Technical Sub-Committee of the Optical Manufacturers Association who are working on industry wide standards at the factory level. They were quick to realize that a change should be made and I was assigned to write a new standard based on a concept which would be more realistic.

If the reason for controlling the centering of ophthalmic lenses is in order to control prism, it is obvious that the centering standards themselves should be based on prism. Glenn Fry, who had given some thought to the same subject, suggested the maximum allowable prism might be set at 1/6 prism diopter, and since the maintenance of such a standard seemed reasonable from a manufacturing standpoint, this was adopted by the OMA. This is the maximum amount of prism which we want to have in the finished prescription, but we are setting standards on finished uncut lenses and there is no reason to restrict the prism in such lenses to exactly this amount, since the Prescription Laboratory can locate the optical center in the proper position in their edging operation. They can do this, however, only as long as the optical center, or a point on the lens which is sufficiently free of prism to be used as the optical center, is close enough to the geometrical center so that the desired eye size and shape can be edged

from the finished uncut blank. It is for this reason that we chose a tolerance of 2 mm. From the geometrical center within which must be located a point which is sufficiently free of prism to be used as the optical center.

Thus, we now have a standard which reads as follows:

"The prism power at the marked point shall not exceed 1/6 prism diopter. The marked point should not be decentered from the geometrical center more than 2 mm."

When we use the above standard where will the actual optical center be? It may be at the marked point, but it doesn't have to be as long as the prism at the marked point does not exceed 1/6 prism diopter. It may be within a 2 mm circle, but it doesn't have to be as long as there is some point within this 2 mm circle (the marked point) which does not exceed 1/6 prism diopter. In the case of medium and high powered lenses it cannot be very far beyond the 2 mm circle, but in the case of weak powered lenses it may be off the lens entirely.

LENS POWER	MAXIMUM DEPARTURE OF OPTICAL CENTER FROM GEOMETRIC CENTER
+5.00	2 mm.
+2.00	3 mm.
+0.50	5 mm.
+0.25	7 mm.
+0.12	10 mm.
-0.12	off the lens
-0.25	13
-0.50	6
-2.00	3
-5.00	2

It is pointed out that the maximum value of 1/6 prism diopter is what was adopted by the OMA, and at present the AO standard is the same. However, as we get into the program we may find that we can tighten this somewhat, and I would be in favor of doing so if possible.

DBW:pja

DB Whitney

cc: WAR, AWR, AH WBR, HGF