

LETTERS TO THE EDITOR

Tono-Pen tonometry

EDITOR,—I congratulate Geyer *et al*¹ on their article warning our colleagues about the problems associated with using a Tono-Pen as a means of measuring intraocular pressure. I have evaluated this instrument in 400 eyes of 200 consecutive patients with normal corneas. The Goldmann measurement was done first and the Tono-Pen second by the same observer. Figure 1 shows our results which are very similar to those reported by Geyer *et al*.

Clinically the term 'intraocular pressure' is the mean ocular pressure around which the pressure varies due to respiratory and arterial pressure waves. This is what is measured with the Goldmann applanation tonometer. Theoretically, repeated measurements with a non-applanating tonometer such as the Tono-Pen should approximate this mean in a reproducible fashion.² This is not so. Repeated measurements on the same subject with a Tono-Pen give reproducible results even where this result is markedly different from the Goldmann measurement.³ Thus, although the Tono-Pen gives reproducible measurements, it is not measuring the same 'intraocular pressure' as a Goldmann tonometer. Future research may show that the tonometer is measuring an important aspect of ocular pressure that has to be taken into account in the management of

glaucoma. At the present time the Goldmann applanation tonometer remains the only acceptable way of measuring intraocular pressure for routine patient care.

It is very tempting to use the Tono-Pen because of its portability, disposable tip cover, and ease of use in a sitting or supine position. I therefore think it is timely and important that it is pointed out that the Tono-Pen is not an accurate means of measuring the same 'intraocular pressure' which we have been accustomed to considering in our management of patients with glaucoma over the years.

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- 1 Geyer O, Mayron Y, Loewenstein A, Neudorfer M, Rothkoff L, Lazar M. Tono-Pen tonometry in normal and in post-keratoplasty eyes. *Br J Ophthalmol* 1992; 76: 538–40.
- 2 Farrar SM, Miller KN, Shields MB, Stoup CM. An evaluation of the Tono-Pen for the measurement of diurnal intraocular pressure. *Am J Ophthalmol* 1989; 107: 411–6.
- 3 Moses RA, Arnzen RJ. Instantaneous tonometry. *Arch Ophthalmol* 1983; 101: 249–52.

Reply

EDITOR,—We thank Drs Beaumont and Kang for their comment. Indeed, their results, as shown by their figure are very similar to ours. We completely agree that at the present time the Goldmann tonometer remains the only acceptable way of measuring intraocular pressure for routine patient care. We are pleased to learn that a conclusion similar to ours was derived by Drs Beaumont and Kang after

evaluating the instrument on a large series of 400 normal eyes.

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Comparison between methods of tonometry: time for a change of approach

EDITOR,—Geyer *et al*¹ write that despite good correlation between Tono-Pen and Goldmann measurements, Tono-Pen tended to overestimate the actual intraocular pressure (IOP) in an unpredictable manner. They think Goldmann measurements are to be preferred. (We wonder if there is a misprint in their Table 2/Figure 6, where some absolute paired differences have smaller means than paired differences?) They may be right about Goldmann tonometry, although we found a smaller and clinically insignificant mean difference in normal eyes.² We have concluded that Tono-Pen may be a good instrument for general practitioners. Goldmann tonometry is no gold standard representing true pressure, only a method which shows less variation than other methods. However, the point here is that the premises for comparison between two methods of tonometry should change.

Correlation deals with how one variable varies with, and as a consequence of, changes in another variable. It does not deal with agreement between two methods of clinical measurement. The correct method is limits of agreement,³ which take into account both systematic differences between the two methods as well as other reasons for variation. There are short time pulsations in the IOP of an eye,⁴ and the way two different measurements are carried out may vary for the same method. The total spread in measurements may be very important for clinical practice even when two methods show little systematic difference.

Limits of agreement tell how much two methods of tonometry are likely to differ in mm Hg. For example, we found that discrepancies of approximately 5 mm Hg between a Tono-Pen and a Goldmann measurement are within limits of agreement in the sense that 95% of the discrepancies in our population sample were within these limits. It means that for a single Tono-Pen measurement of, say, 17 mm Hg in a normal eye, there is a 95% probability that a Goldmann measurement in the same eye will lie somewhere in the range from 12 to 22 mm Hg, but how close to 17 mm Hg we do not know.² Nor do we know how close 17 mm Hg is to actual value. The clinical significance of this varies according to the use in screening or in clinical practice.⁵

Many authors have problems in interpreting the clinical significance of combined correlation coefficients and mean differences, as shown with references in our paper.² Limits of agreement show both mean differences and the spread of the measurements. The use of correlation is dubious.

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- 1 Geyer O, Mayron Y, Loewenstein A, Neudorfer M, Rothkoff L, Lazar M. Tono-Pen tonometry in normal and in post-keratoplasty eyes. *Br J Ophthalmol* 1992; 76: 538–40.

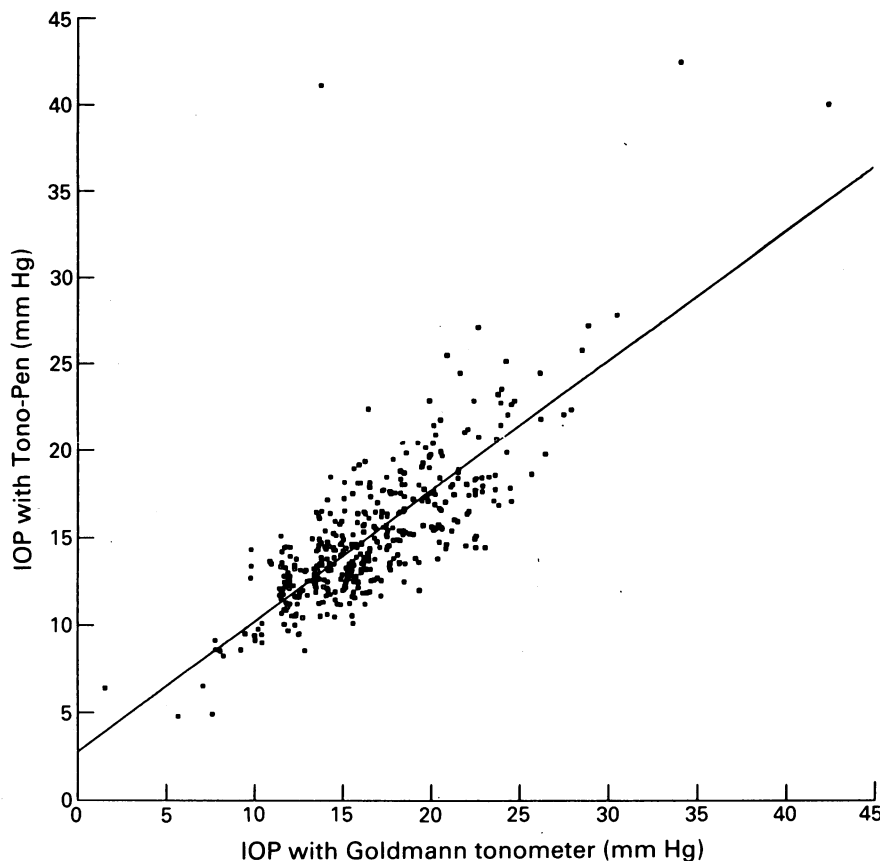


Figure 1 Scattergram and linear regression comparing Goldmann and Tono-Pen measurements of intraocular pressure (IOP), $r=0.81$.