

## Re. Calibration of Peak Expiratory Flow (PEF) measuring devices

There are increasing numbers of devices coming onto the market for measuring PEF and of papers assessing their performance. In these papers a number of different ways of calibrating the devices have been used, as discussed in your correspondence columns [1]. What is the best way to calibrate a peak flow (PF) meter for clinical use?

It seems not to be realized that compared with a large pneumotachometer, portable PF meters have an appreciable resistance to airflow. This will have a measurable effect on the very thing being measured, *i.e.* the PEF. When WRIGHT and MCKERROW [2] calibrated their original instrument in 1959 they used a form of calibration which allowed for this. Having calibrated a large low resistance pneumotachometer with calibrated rotameters and steady flows, they had their subjects make alternate blows through the pneumotachometer and the PF meter. The resulting calibration gave PEF readings which were the flows that would have resulted had the meter had the resistance of the pneumotachometer, not the actual flow through the meter. This, of course, is what the clinician wants. Using this form of calibration any other instrument should give similar results in the same subject.

Actually, the original Wright meter did not have a very high resistance, so that the difference between its calibration and absolute was small. The mini Wright PF meter has a resistance about three times as great and so it is not surprising that when calibrated in absolute flows it is found to over-read slightly [3]. Other devices with higher resistances will be more affected. This does not matter since the "error" seems to be systematic and can be allowed for providing the calibration is of the type described above. The drawback of this method is that the blows into the two instruments (pneumotachometer and PF meter) will not be identical. However, by using a large number of blows this "noise" can be largely eliminated.

The purist approach might be to calibrate meters in absolute terms, using for instance the method of SHAPIRO *et al.* [3]. Subjects blow through a pneumotachometer in line with the meter, having calibrated it first with the

meter in place. It would then be necessary to work out and apply some correction factor unique to that meter to increase the result to that which would have been obtained on a low resistance pneumotachometer. However, this is clearly unnecessarily cumbersome for clinical use.

It is being suggested that in future PF meters and electronic spirometers should be calibrated by computer-controlled piston devices designed to deliver artificial forced expirations having flow/volume loops similar to human subjects and patients. This would seem, at first sight, an ideal method of calibration and standardization. However, apart from formidable problems of turbulence at high flows, since these machines will be designed to deliver their standard forced expirations, regardless of the resistance of the device being calibrated, they will not simulate the human lungs in this respect and devices calibrated in this way will not have the correction for resistance built into their calibration.

It would seem better to continue to use the less elegant but clinically more useful method of WRIGHT and MCKERROW [2], or having calibrated a standard Wright meter by their method to use that as a secondary standard against which to calibrate newer meters.

### References

1. Inbruce RP. - Accuracy and reproducibility of the assess peak flow meter (letter). *Eur Respir J*, 1991, 4, 632.
2. Wright BM, McKerrow CB. - Maximum forced expiratory flow rate as a measure of ventilatory capacity. *Br Med J*, 1959, 2, 1041-1047.
3. Shapiro SM, Hendler JM, Ogirala RG, Aldrich TK, Shapiro MB. - An evaluation of the accuracy of assess and mini Wright peak flowmeters. *Chest*, 1991, 99, 358-362.

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