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HOME UROFLOW DEVICE: BASIC BUT MORE ACCURATE THAN STANDARD IN-CLINIC UROFLOWMETRY?

<u>Hypothesis / aims of study</u>

Although uroflowmetry is a standard and relatively straightforward test, it is often difficult to obtain clinically useful readings. This can be due to abdominal straining, over and under filling of the bladder or simply because the patient could not void at all - the “bashful bladder”. It has been suggested that multiple consecutive flows should be obtained in the clinic and the best one used for assessment, although this is time-consuming, uneconomic and often impractical. Conceptually the primary aim of any urodynamic measurement is to reproduce symptoms but this is unlikely to be achieved by asking the patient to rapidly fill their bladder repeatedly in a short period of time.

We investigated the use of a simple home uroflow device, similar in concept to previous designs [1,2], which categorises Q_{max} into one of 4 ranges: <10ml/s; 10-15ml/s; 15-20ml/s; >20ml/s to give a reasonably accurate estimate of standard readings [3]. Though a single measurement may be less precise than obtained from a conventional flowmeter, the situation may be different for multiple measurements. It is well-established in digital sampling theory that if the inherent variability of a signal is at least half the "quantisation" resolution (in our case, at least 2.5 ml/s), the average of multiple measurements will have greater precision than the step size would suggest. Since there is inherent variability in flow rate, we speculate that the Q_{max} obtained would be consequently more representative of the patient’s usual voiding function.

<u>Study design, materials and methods</u>

The device (Fig.1a) is a clear plastic funnel with a 4.6mm aperture. As urine is passed through the funnel, it will exit through the hole but also rise in the funnel until inflow is balanced by outflow (which increases with height). The maximum height reached by the urine during the void gives an indication of Q_{max}. We recruited 25 volunteers, (mean (SD) IPSS 8.7 (7.8)), with a wide range of Q_{max}. They were given a funnel device, measuring jug and a pictorial chart (Fig.1b) to record flow category and voided volume (V_{void}) twice daily for 12 days. In addition, a clinic-based flow recording was obtained at both the start and the end of the 12-day period, using a spinning-disc uroflowmeter (Urodyn1000, Medtronic Ltd, Watford UK). The following comparisons were considered using Bland Altman analysis to assess accuracy and reliability using the clinic flow as the standard:

Accuracy - the mean of all home readings, against the mean of the two clinic readings (Clinic/Home);
Test-retest reliability - mean of the first half of home readings against the mean of the second half (to take into account any missing data, Home1/Home2).
By comparison - first versus second clinic reading (Clinic1/Clinic2).

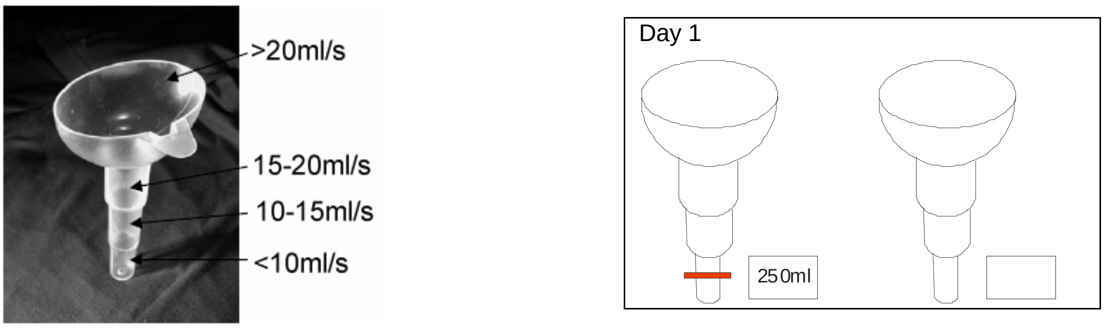
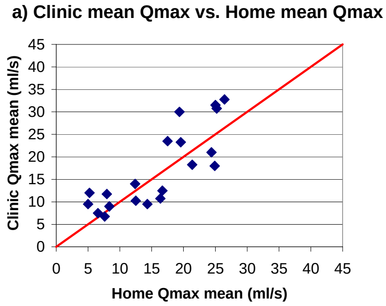


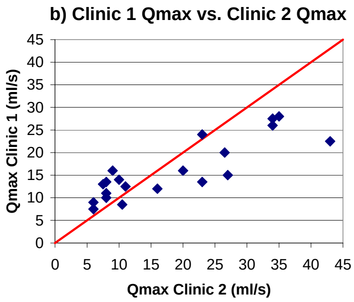
Figure 1: a) Simple plastic home flow meter. b) Part of pictorial recording chart.

<u>Results</u>

A total of 20 men provided the clinic and home flow readings whilst 5 subjects were excluded due to incomplete home data (2), inability to provide a clinic-based flow (1) or inability to attend clinic (2). For voided volume, the overall mean (SD) were 285 (163) ml for the clinic readings and 312 (175) ml for the home readings.

*Accuracy - a*greement between mean home flow and clinic flow (Fig. 2a) was similar to a previous study [3], with no evidence that the clinic and home flows are significantly different.
Test-retest reliability – the mean home flow for consecutive halves of an individual’s data showed excellent agreement (Figure 2b, Table 1).
*By comparison - t*he 2 clinic readings (Fig. 2c) showed poorer agreement than the home readings, and poorer agreement even than between clinic and home flows.





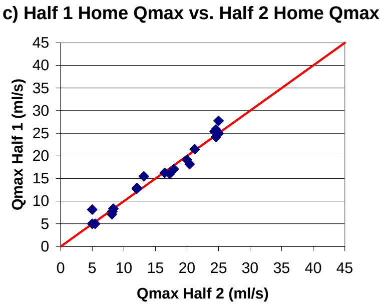


Table 1: Bland and Altman Statistics	**Mean difference (ml/s)**	**SD of difference (ml/s)**	**95% CI for the mean difference**
Clinic/Home	1.3	5	-0.9 to 3.5
Home1/Home 2	-0.2	1.4	-0.8 to 0.4
Clinic1/Clinic 2	2.3	7	-0.8 to 5.4

Fig.2: X-Y plots to show comparative accuracy (a) and reliability (b,c) of the methods.

Interpretation of results

Accuracy and repeatability for multiple use of the funnel device (Fig.2c) are both better than for measurements using a standard spinning-disc flow meter (Fig.2b). Indeed, the agreement of the clinic flow with the home device was better than that for two clinic flows. This can only be explained if the inherent accuracy of repeated measurements using the home device is better than that for the clinic flow.

Concluding message

Although simple in design, the home flowmeter actually shows a greater accuracy than might be expected when it is used repeatedly. This method of home uroflowmetry illustrates the fact that in-clinic measurements may not be as representative of the patient's usual Q_{max} due to the natural variability of flow rate. The home flowmeter device was well accepted by the volunteers as a simple and practical test, in comparison to clinic-based measurements. One volunteer, who was excluded from the study because he was unable to void on 3 occasions using the standard clinic-based flowmeter, was nevertheless able to use the funnel device on multiple occasions in his own home. We suggest that simple flow devices such as this one could be used in conjunction with voiding diaries to give a more representative picture of patients' day-to-day voiding function.

[1] Neurourol Urodynam, 2002; 21: 48-54.
[2] Urology, 1998; 52: 1118-1121.
[3] Non-Discussion Poster, ICS 2005; Abstract 200.

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