Grip strength is used as a measure of capacity in a number of settings including disability and personal injury claims. Although seemingly an objective measure, it is widely recognised that it is fallible to the effects of sub-maximal effort (SME).

The most widely used method of measurement of grip-strength is the Jamar dynamometer, which is an adjustable hand-held device that measures grip strength over five widths (Fig 1).

What I want to know when testing is:
(i) Has the patient lost power?
(ii) Is the test valid?

The power that can be applied over the five settings of the dynamometer usually exhibits a skewed bell-shaped curve; the maximum power being almost always achieved at either setting 2 or 3.

The loss of the bell-shaped curve was proposed as a sign of feigning. It has been my experience that patients also exhibit eccentric, non-physiological curves after injury. The analysis of five-position test has therefore been expanded.

I have developed an extended test protocol to mitigate the effects of inconsistency whilst retaining the ability to detect SME (Fig 2). The protocol comprised two tests at each Jamar position. The sequence starts from the first and narrowest position on the uninjured hand, followed by the first position on the injured hand, the second position on the uninjured hand, etc. Following the 5th test on the injured hand at the widest handle setting, the sequence is reversed. The largest value for the two attempts at any given side and position was used for analysis.

Curve variation The dynamism of the curves was assessed by calculation of the CoV between the five results for each hand, which was multiplied by 100 to produce a percentage score.

Curve deviation The shape of the curves was assessed by calculation of the percentage differences between each of the five normalised values and the values derived from a normal population.

This protocol was used in 150 consecutive patients who had suffered unilateral upper limb injuries undergoing medicolegal assessment at a median interval of 21 months from injury. Their median age, whole limb impairment (WLI) and QDASH were 42yr, 3% and 42 respectively.

The median difference in maximum power between injured and uninjured sides was 24%. This difference was correlated with the WLI (R=0.35, p<0.001) and QDASH (R=0.52, p<0.001). Maximum power was exerted at position-2 in 122 of uninjured hands compared with 99 in injured hands (p<0.005).

Patients were less consistent in test performance with their injured compared with uninjured hands (median values of 9.2% vs 6.7%, p<0.001). The curves achieved by injured hands were significantly albeit slightly more dynamic (20.1% vs 17.5%, p<0.001) and deviated more from the expected curves than the injured hands (9.9% vs 6.6%, p<0.001). 61 patients had at least one of these qualitative measures outside the 95th percentile range for normal subjects, suggesting that their results were unreliable (Fig 4).

Consistency was assessed by calculation of the coefficient of variation (CoV) of the ten squeezes.

The values obtained from the five results in each hand were normalised by division of each value by their mean and plotted against handle position (Fig 3).

Fig 1: Jamar dynamometer at position-2. Grip strength in injured and uninjured hands in the study.

Fig 2: Testing protocol.

Fig 3: Normalised power in injured and uninjured hands in the study showing normal curve physiology despite differences in the raw power.

Fig 4: Numbers and types of atypical test performances in injured hands. Two examples of atypical curves; one eccentric, one flat.