

EVALUATION OF GRIP LOSS

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In assessing the degree of permanent disability after a hand injury, the loss of grasping power is a measurable factor and is therefore of value. In this article, which is prepared by the author for the Committee on Industrial Health and Rehabilitation of the California Medical Association, the various factors involved in weakening the grip, and the various methods of accurately measuring the grip loss are considered.

An instrument for accurately measuring comparative loss of grasping power is known as a dynamometer. There are three types, each incorporating a different principle:

The Geckeler dynamometer is a pneumatic instrument which records the compression of a rubber bulb (a rolled-up blood-pressure cuff may be used in a similar way). The method, however, is generally inaccurate and unreliable as a quick jerk of the hand on the cuff may give almost any reading.

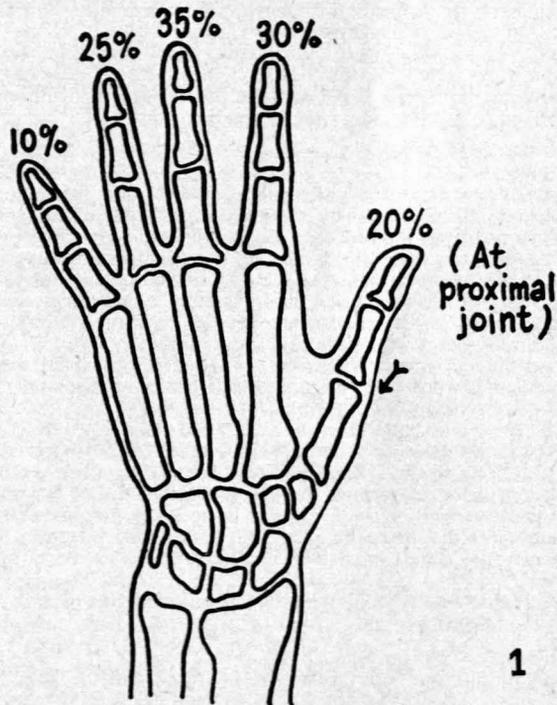
The Collins dynamometer incorporates an oval spring, the compression of which activates a pointer across a dial. However, the lack of uniformity of the spring, and the discomfort which it causes in the hand on using the instrument, discourages the patient from gripping as strongly as he might and makes the instrument inaccurate and unacceptable.

The third type is the Jamar dynamometer, which is unanimously recommended by the committee. It incorporates a sealed hydraulic system, and differs from the previous two types in that it measures grip *force* and not grip *pressure*. This is important since two hands with similar functional grasps will show different grip *pressures* if they are of different sizes, since in the larger hand the same force is spread over a larger area. On the other hand the *grip force* is not dependent on the size of the hand, nor is it affected if one or more fingers are amputated. This instrument therefore records a more accurate measurement of relative function.

Loss of grasping power is measured as a percentage of the estimated normal for that hand. In estimating this normal, the uninjured opposite hand is used as the basis for comparison, the grip in the major hand being arbitrarily assumed to be 10% greater than in the minor hand. For example, if the uninjured hand is the minor hand and its dynamometer readings average 100 lb., then the injured major hand's estimated normal should be 110 lb. If the dynamometer reading in this hand is, however, only 70 lb. then the percentage grip loss in this injured major hand is $40/110$ or 36%.

Even an accurate dynamometer can be misleading under certain circumstances, however. Errors may arise owing to confusion as to which is the major and which is the minor hand, while to be accurate the dynamometer presupposes that the normal extremity is in fact perfectly normal and that the extremity under assessment was normal before the injury under review. Any

pre-existing abnormality in either the normal extremity or the extremity under assessment invalidates the calculation, as of course does any failure on the part of the patient to cooperate with his best efforts. The dynamometer assessment should therefore be considered in the light of a careful clinical evaluation of all the factors which cause grip loss, for in practice any functional impairment of the hand can affect its grasping power. Amputations of fingers and thumb, limitations in joint movements of the fingers and thumb, pain, and muscular weakness or incoordination, may all be factors in reducing the grasping power, and in practice more than one of these disabilities is usually found to be operating in any single case.



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Fig. 1. Estimated approximate percentage of grip loss due to amputation of entire finger. For partial loss of any finger: approximate loss at middle joint— $\frac{2}{3}$ value of finger; approximate loss at distal joint— $\frac{1}{5}$ value of finger. (Kirkpatrick, J. E. (1957): *Industrial Medicine and Surgery*, 26, 287—by permission.)

* From *Industrial Medicine and Surgery* (1957), 26, 285. Published at the request of the Workmen's Compensation Commissioner, Pretoria.

The approximate grip loss which may be anticipated after various levels of amputation in the fingers and thumb is illustrated in Fig. 1, while limitation of finger and thumb movements also bears relationship to grip loss, and although this ratio is not reliable, it is of value in calculating the grip loss which may be anticipated, from which may be deduced whether the case is ready for final assessment or not.

Pain in the hand, the wrist, the elbow or the shoulder is another factor which may affect the grip of the hand, and its importance may be evaluated by obtaining (1) a description of the activity which produces the disability, (2) the duration of the disability, (3) the activities which are precluded and those which can be performed with disability, and (4) the means for relief. Pain as a disabling factor may also be graded into degrees of severity as follows:

(a) a severe pain would preclude the activity precipitating the pain.

(b) a moderate pain could be tolerated but would cause marked handicap in the performance of the activity precipitating the pain.

(c) a slight pain would cause mild handicap in the performance of the activity precipitating the pain.

(d) a minimal pain would constitute an annoyance but would not interfere with activity.

Muscular weakness will also result in grip loss and is usually associated with muscular wasting. Most persons doing active work have a greater girth on the major side, but the difference may vary from almost nothing in a frail female worker to nearly

an inch in the girth of the arm of a strong male. Equal bilateral measurements of girth in active persons usually indicates some atrophy of the major side but a small decrease in girth on the minor side is usually not significant. Measurements of the girth of the arms and forearms of both injured and uninjured extremities should therefore be recorded.

The coordination of muscular action is an important factor in developing an adequate grip and therefore any failure of fixation of the wrist by the extensors, as in tenosynovitis or radial nerve palsy etc. interferes markedly with the normal grip.

To summarize, therefore, in examining any upper extremity for assessment purposes the following information is necessary:

1. The girth of the arms and forearms on both sides, as evidence of muscular wasting and muscle weakness.
2. Measurement of joint movements and the distances in inches between the tips of the fingers and the distal palmar crease after the fullest finger flexion possible.
3. A description of any pre-existing defect or grip loss in either the injured or uninjured extremity.
4. A statement as to which is the major hand.
5. Dynamometer readings (with the Jamar dynamometer) of the injured and uninjured sides, the average of three readings being taken.
6. A description of the original injury, the course and duration of the treatment and the end result.