
Grip Strength and Hand Dominance: Challenging the 10% Rule

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The purpose of this study was to test the utility of the 10% rule in hand rehabilitation. The 10% rule states that the dominant hand possesses a 10% greater grip strength than the nondominant hand. This rule has been used for many years to assist therapists in setting strength goals for patients with injured hands. The sample for this study consisted of 310 male and female students, faculty, and staff from a small, private liberal arts college located in Pennsylvania. Grip strength was measured with a factory-calibrated Jamar dynamometer. Results showed an overall 10.74% grip strength difference between dominant and nondominant hands. This finding verified the 10% rule. However, when the data were separated into left-handed and right-handed subjects, a 12.72% difference for right-handed subjects and a -0.08% difference for left-handed subjects was found. In conclusion, this study showed that the 10% rule is valid for right-handed persons only; for left-handed persons, grip strength should be considered equivalent in both hands.

Measurement of grip strength is an important component of hand rehabilitation because it assesses the patient's initial limitation as compared with norms. Its utility continues throughout the treatment process because it provides a quick reassessment of the patient's progress. Although a minimum grip strength of only 20 lb is essential for performing basic daily activities (Nalebuff & Phillips, 1984), most therapists set a higher goal to help their patients achieve a greater overall improvement in function. Therapists often use the *10% rule* as a general guideline for such goal setting. This rule states that a person's grip strength in the dominant hand is approximately 10% greater than in the nondominant hand (Bechtol, 1954). For example, the grip strength goal for a patient with an injured right (dominant) hand who has a left (nondominant) hand grip strength of 100 lb should be 110 lb, excluding adjustment for the extent of injury and other variables.

The 10% rule dates back to 1954, when Bechtol observed that most patients presented a difference of 5% to 10% between their dominant and nondominant hands on grip measurements; the dominant hand was stronger. Several studies have since been conducted to establish normative data for grip strength measurements to be used as treatment guidelines. However, as will be shown, these studies did not address right- and left-hand strength differences in relation to dominance. In one study, Kellor, Frost, Silberberg, Iversen, and Cummings (1971) ignored the factor of handedness. They combined the data of left-handed subjects with those of right-handed subjects because only a small percentage of subjects claimed to be left-handed.

In a study by Mathiowetz, Kashman, et al. (1985), data for both sexes revealed that the right hand was stronger than the left hand. Separate analysis of left-hand and right-hand data showed little functional differences in mean scores. This finding does not support the 10% rule. The authors suggested that, considering the minimal difference in scores between the two, it was justifiable to combine left-hand and right-hand data.

Other studies offer some support for the 10% rule as it is currently used. Lunde, Brewer, and Garcia (1972) conducted a 3-year study of 57 college women to examine nutritional status; in this study, grip strength was but one of many variables. The data for the grip strength variable consisted of 107 measurements. Overall findings indicated that there was a 13% grip strength advantage in the dominant hand. A review of the data for each measurement, however, revealed that strength readings for the nondominant hand were equal to or greater than readings for the dominant hand in 24% of the 107 measurements.

In a larger study (Schmidt & Toews, 1970), 1,128 male and 80 female job applicants were tested for grip strength as part of their physical examination for employment at a large manufacturing firm. No time span for the study was given. Mean grip strength for the dominant hand in the male subjects was 113.1 lb and for the nondominant hand, 109.6 lb. From these data, a strength advantage of 10.3% was calculated for the dominant hand; this result supports the 10% rule.

Schmidt and Toews (1970) then examined individual scores and looked at right-hand and left-hand data separately. They found that 22.6% of the men were stronger in their nondominant hand, and 5.4% were of equal strength bilaterally, which resulted in 28% of the men having a grip strength in their nondominant hand that was equal to or greater than the grip strength in their dominant hand. On the basis of this finding, Schmidt and Toews questioned the application of the 10% rule in such areas as worker's compensation.

In a study of 50 men and 50 women (Swanson, Matev, & de Groot, 1970), the grip strength of the nondominant hand was equal to or greater than that of the dominant hand in 29% of the subjects. The proportion of left-handed subjects in the sample was not specified.

In these last three studies, 24% to 29% of the subjects had grip-strength readings in their nondominant hand that were greater than or equal to the grip strength readings in their dominant hand. On this basis alone, the utility of the 10% rule could be challenged. Unfortunately, data from left- and right-handed subjects in these three studies were not analyzed separately but were combined. To make any statements about the applicability of the 10% rule, the

combining of right- and left-hand data for analysis is not sufficient. Our study examined the generalizability of the 10% rule. We asked the following questions: (a) Does the rule apply to both right-handed and left-handed subjects? and (b) Will it need to be modified?

Method

Subjects

A sample of 310 volunteers (125 men, 185 women) was used. Subjects ranged in age from 17 to 50 years and included 284 college students (aged 17 to 30 years), 18 faculty members (aged 23 to 50 years), and 8 staff members (aged 18 to 40 years). All were associated with a rural private college of 1,400 students in Pennsylvania and were made aware of the study through advertisements in the campus newspaper and posters placed in locations with high visibility. Of the 310 participants, 262 were right-hand dominant (108 men, 154 women) and 48 were left-hand dominant (17 men, 31 women). Subjects were not paid for their participation.

Equipment

A standard, adjustable-handle Jamar dynamometer¹ was used to measure grip strength. This device was new for the study and was factory calibrated. The second or third position (of the five positions available) was used, depending on the comfort of the subject, as recommended by Kellor et al. (1971). Once a setting was chosen by the subject, it was used for both the right and the left hand. The dynamometer was reset to zero prior to each reading of grip strength, and it was read to the nearest increment of two.

After the study, the dynamometer was checked for accuracy with the setup presented in Schmidt and Toews (1970). A .98 correlation coefficient was calculated between the dynamometer reading and the loading of the calibrated weights. A further check of interrater reliability resulted in a .99 correlation coefficient.

Procedure

Before testing, a brief interview was conducted with each subject to record the following: subject identification number (to avoid repetition of data), age (to the nearest birthday), sex, and previous and current hand injuries (including fractures, nerve injury, tendon injury, arthritis, partial amputation, and tendonitis). At the time of testing, subjects judged that they did not have any hand pain or limitation that might influence their grip strength. Hand dominance was determined by asking each subject, "Are you right- or

¹ Manufactured by Asimow Engineering Company, Los Angeles, CA 90024.

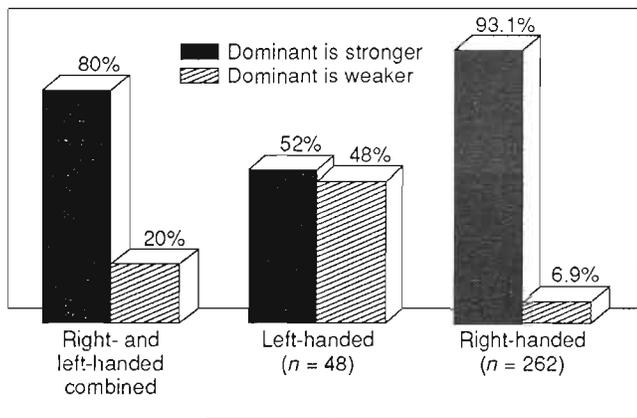


Figure 1. Grip strength in right-handed and left-handed subjects (in percentages).

left-hand dominant?" No ambidextrous subjects participated in this study. The interview concluded with the subject signing the consent form.

The research took place on 2 consecutive days for 3 hours each day. Each subject was seated in a standard-height chair without armrests and placed his or her feet flat on the floor. For each grip strength test, the standardized position recommended by the American Society of Hand Therapists (Fess & Moran, 1981) was used: The subject was seated with shoulder adducted and neutrally rotated, elbow flexed at 90°, and the forearm and wrist in neutral position. Each subject was also positioned between 0° and 30° wrist extension and between 0° and 15° of ulnar deviation as well as given standard instructions for participation (Mathiowetz, Rennells, & Donahoe, 1985). The subject was asked to give maximum effort.

After the subjects had sufficient time to familiarize themselves with a practice dynamometer, the grip bar of the research dynamometer was set for each subject. Two trials for each hand were conducted, alternating right and left hands. To counterbalance any order effect of the starting hand, every other subject began the grip strength test with the right hand, while those in between began with the left hand. The instructions were presented as recommended by Mathiowetz, Kashman, et al. (1985). The same researcher read the dynamometer dial to record the various trials. The stronger reading for each hand was recorded. To compute the percent difference between hands, the score of the nondominant hand was divided by the score of the dominant hand, and this value was subtracted from 1. For example, for a right-handed subject with a right-hand score of 80 lb and a left-hand score of 72 lb, the calculation would be $1 - (72/80) = .10$ (10%). The calculation for a left-handed subject with a right-hand score of 125 lb and a left-hand score of 121 lb would be $1 - (125/121) = -0.03$ (-3%).

Each subject had a right-hand score, expressed in pounds; a left-hand score, expressed in pounds; and a percent difference score, expressed as a percentage.

Results

To compare our results with those of other studies, we examined individual scores to identify the number of subjects whose nondominant hand strength score was equal to or greater than their dominant hand strength score. Of our 310 subjects, 61 (20%) had nondominant hand strength scores that were equal to or greater than their dominant hand strength scores. This percentage falls near the values (24% to 29%) found by others (Lunde et al., 1972; Schmidt & Toews, 1970; Swanson et al., 1970). The percentages reported in the literature, however, may be misleading, because separate analyses for right- and left-handed subjects were not conducted. Our study does contain such separate analyses, and the results are revealing. Of the 48 left-handed subjects, 23 (48%) were stronger in their right, nondominant, hand. Of the 262 right-handed subjects, only 38 (6.9%) were stronger in their left, nondominant, hand. Most of the subjects who were stronger in their nondominant hand were left-handed (see Figure 1).

The data were then analyzed for right- and left-hand differences in strength as expressed in percentages. The percentage difference scores between hands across the sample of 310 subjects support the 10% rule. An overall 10.74% difference was found when combined dominant and nondominant hand strength scores for all subjects were used. However, upon separate analysis of right- and left-hand scores, we found that the 10% rule was applicable to right-handers but not to left-handers (see Table 1).

Right-handed men ($n = 108$) had a mean percentage difference score of 9.2%; right-handed women ($n = 154$) had a score of 15.8%. Combined data for right-handed men and women showed a 12.7% strength advantage. Left-handed men ($n = 17$) had a percentage difference score of +1.9%, which showed that their dominant hand was 1.9% stronger. Left-handed women ($n = 31$) had a percentage difference score of -1.2%, which demonstrated that their dominant hand was weaker than their nondominant hand. Combined data for the right and left hands of left-handed subjects showed no differences between hands. Clinically, the strength of the right and left hands in left-handed persons could be considered to be equivalent.

Discussion

An overall 10.74% grip strength difference was observed across subjects. This finding supports the rule

Table 1
Grip-Strength Scores of Right- and Left-Handed Subjects

Subjects	Hand	Score			
		Mean (lb)	Mean Percentage Difference ^a (%)	Minimum (lb)	Maximum (lb)
Right-handed					
Men (n = 108)	R	114.58	9.20	64	180
	L	105.64		60	168
Women (n = 154)	R	70.90	15.80	43	127
	L	61.87		32	115
Total (n = 262)	R	88.91	12.72	43	180
	L	79.92		32	168
Left-handed					
Men (n = 17)	L	110.71	1.90	83	138
	R	109.12		85	135
Women (n = 31)	L	66.84	-1.20	40	94
	R	68.58		45	91
Total (n = 48)	L	82.38	-0.08	40	138
	R	82.94		45	135
Total (N = 310)	R	87.90	10.74	40	180
	L	80.38		32	168

Note. R = right; L = left.

^a This score was calculated with individual data for each of the groups; it was not calculated with the mean score for each group.

that the dominant hand is about 10% stronger than the nondominant hand. However, the same data showed that 20% of the sample (61 of 310 subjects) possessed nondominant hand strength equal to or greater than that of their dominant hand. The disparity is due to the fact that the data of the left- and right-handed subjects were combined. Because of this averaging, the impact of the small quantity of significant data of the left-handed subjects is lost. For example, 48% of the left-handed subjects were stronger or equal in strength in their nondominant hand, whereas only 6.9% of the right-handed subjects were stronger or equal in strength in their nondominant hand.

In our research, the 10% rule as originally stated did not hold true when data for right- and left-handed subjects were analyzed separately. Right-handed subjects showed a 12.72% strength difference, while left-handed subjects (men and women) showed a 0.08% strength difference. Although the results of this study do not support the 10% rule for both right- and left-handed patients, they do support its clinical use for right-handed patients. For left-handed patients, however, the rule does not apply. To set goals for these patients, clinicians should use normative data or consider the hands to be equivalent in strength.

A limitation of this study was the use of an accidental sample in a college setting. Therefore, results may not apply to other groups, for example, factory workers, beauticians, or farmers. To make generalization possible, research with other groups is necessary.

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