

Grip Strength: Effect of Hand Dominance

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ABSTRACT

Aim of the study: Reliable and valid evaluation of hand strength is important for determining the effectivity of treatment strategies and it is accepted that grip and pinch strength provide an objective index for the functional integrity of upper extremity. This study was designed to evaluate the grip and pinch strength differences between sides for the right and left handed population.

Methods: The study included 128 right and 21 left hand dominant volunteers. Grip strength of the participants were measured by using a Jamar dynamometer. Pulp pinch strength measurements were performed by manual pinchmeter.

Results: When the study group was totally evaluated, a statistically significant difference was found between the grip and pinch strengths of dominant and nondominant hands in favour of the dominant hand. For further information we grouped 149 participants as right and left handed and investigated the number of subjects with stronger nondominant hand for each group. The percentage of stronger nondominant hand grip was 10.93% and 33.33% for right and left handed groups respectively. The results were less significant for pinch strength with 28.12% and 28.57% for right and left handed subjects respectively.

Conclusion: We concluded that the dominant hand is significantly stronger in right handed subjects but no such significant difference between sides could be documented for left handed people.

Keywords: grip strength, pinch, hand dominance, Jamar

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measurements provide an objective index of the functional integrity of the upper extremity⁽¹⁾. The Jamar dynamometer has been found to give the most accurate and acceptable measures of grip strength and pinchmeter is used to quantify the finger pinch strength⁽²⁻⁴⁾.

Recent studies have attempted to provide a definitive picture of the difference between dominant and nondominant hand strengths. Crosby et al investigated normative values of hand grip, pulp and key pinch and claimed that the population as a whole demonstrated significant differences between the dominant and nondominant hands⁽⁵⁾. In their study, hand grip and pulp pinch strengths were 6% and 5% higher for the dominant hand respectively.

There are controversies regarding the differences in hand grip strength values between the dominant and nondominant hands in left and right handed people. So this study was designed to evaluate the grip and pinch strength differences between sides for right and left handed population.

METHODS

Subjects

The study included 149 volunteers (81 male, 68 female) aged 24-60 years (mean 30.21 ± 5.91 years). Participants were recruited from the residents and fellows of different departments at Ankara Research and Education Hospital. Criteria for inclusion were that there was no restriction of movement in the upper limbs and no history of inflammatory joint disease, neurological disorder or injury to the upper extremity by self report. Dominant hand was defined as the one preferred for daily activities like writing and eating and for handling heavy objects. Hundred and twenty-eight participants were right hand dominant and 21 were left hand dominant. No participants reported ambidexterity.

Instrumentation and Procedures

All measurements were obtained by two observers at the same time of the day (between 10:00 and 12:00 am). Grip strengths were measured using a standard adjustable handle Jamar dynamometer at standing position with shoulder adducted and neutrally rotated and elbow in

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INTRODUCTION

Reliable and valid evaluation of hand strength is of importance in determining the effectivity of different treatment strategies or effects of different procedures. It is widely accepted that, grip and pinch strength

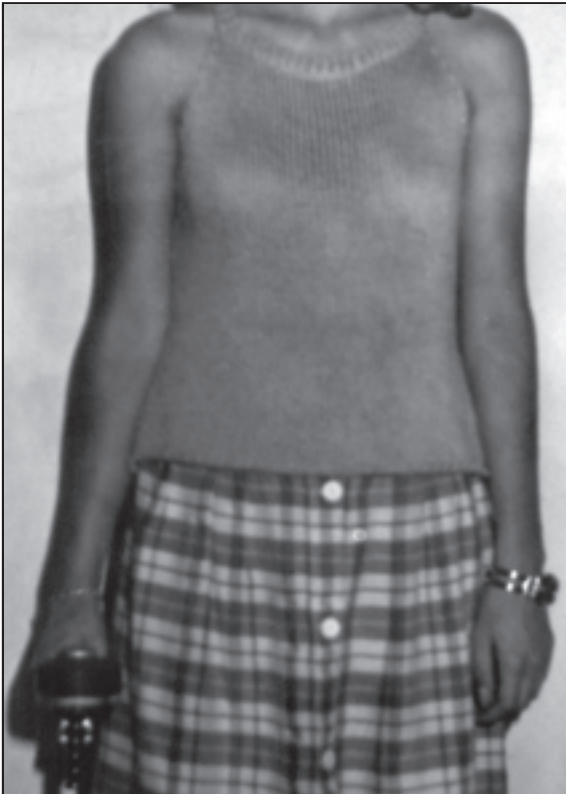


Fig. 1 Test position: Participant is holding the Jamar with shoulder adducted, neutrally rotated and elbow in full extension.



Fig. 2 The manual pinchmeter.

Table I. The minimum and maximum grip and pinch strength values for dominant and nondominant hands.

	Dominant hand min-max (mean \pm S.D)	Nondominant hand min-max (mean \pm S.D)
Grip strength (kgms) (standing-elbow in extension)	38-160 (86.06 \pm 24.71)	36-155 (79.13 \pm 23.68)
Pinch strength (kgms)	4.5-13.5 (7.82 \pm 2.10)	4-12 (7.07 \pm 1.85)

full extension. Results were recorded as kilograms (Fig. 1). For standardisation, the dynamometer was set at the second or third handle position of which the participant claims to be more suitable⁽⁶⁾. For most of the participants second position which was considered to be the best level for grip evaluation and adopted by the American Society of Hand Therapists for routine testing has been used⁽⁷⁾. Pulp pinch strength were measured between the first and second digits. Pinch strength measurements were performed with the subject seated by using manual pinchmeter which measures finger prehension force (Fig. 2). All measurements were performed for both dominant and nondominant hands. Subjects performed three maximum attempts for each measurement and the average value of these trials was recorded. One-minute rests were given between each attempt and hands were alternated to minimise fatigue affects. No verbal encouragements were performed. The calibration of both instruments was tested periodically during the study.

Statistical analysis

The SPSS 8.0 for Windows package program was used for statistical analysis. The data were analysed using Mann-Whitney U test and student's t test. p values equal to or less than 0.05 were accepted as significant ($p \leq 0.05$).

RESULTS

Our study group consisted of 21 left and 128 right hand dominant total 149 participants. The minimum, maximum and mean values for grip and pulp pinch strength of these participants are shown in Table I.

When overall data of the two groups were evaluated, a statistically significant difference was found between the grip strengths of dominant and nondominant hands ($p < 0.05$). Pulp pinch strength values were also significantly different ($p < 0.005$). Twenty-one of the participants (14.09%) had at least equal or higher grip strength scores and 42 (28.19%) of them had equal or higher pinch strength scores in their nondominant hands compared to their dominant hands.

When the right and left handed groups were individually evaluated, the percentage of stronger

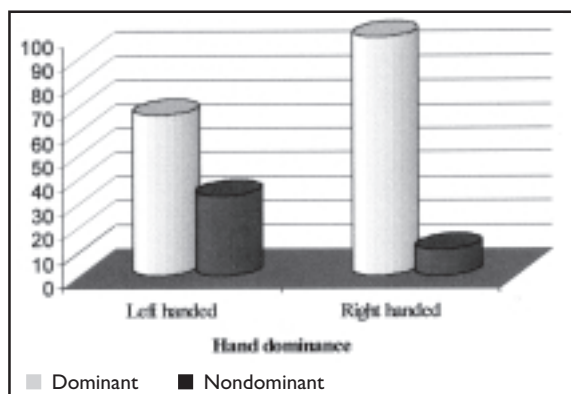


Fig. 3 Comparison of percentages of stronger nondominant hands for right and left handed subject groups.

nondominant hand grip were found to be 10.93% and 33.33% for right and left handed groups respectively. Pulp pinch scores were also evaluated and the percentage of higher nondominant pinch scores were 28.12 % and 28.57% for right and left hand dominant subjects respectively (Fig. 3).

When we separated the 21 participants with stronger nondominant hand grips and evaluated their pulp pinch scores, we noticed that 13 of these participants (61.90%) had equal or higher pinch scores at their nondominant hands. This ratio is much higher than the overall group values.

The difference of hand grip strength values between dominant and nondominant sides were found to be more significant in the right handed group. The grip strength scores were 8.20% and pinch strength scores were 9.43% higher at dominant sides compared to nondominant sides and the difference is statistically significant. This difference was not significant for assessments in the left handed group (3.20% and 5.31% for grip and pinch strength respectively).

DISCUSSION

Measurement of grip strength is an important component for hand rehabilitation. It assesses the patient's initial limitations and provides a quick reassessment of patient's progress throughout the treatment.

The power grip is the result of forceful flexion of all finger joints with the maximum voluntary force that the subject is able to exert under normal biokinetic conditions^(8,9). The grip strength is affected from many conditions and some studies had been designed to identify these factors. Muscle strength is one of these factors. The synergistic action of flexor and extensor muscles and the interplay of muscle groups is an important factor in the strength of resulting grip⁽⁸⁾. Many factors including fatigue, hand dominance, time of day, age, state of nutrition, pain, cooperation of the patient and presence of

amputations, restricted motion, pain and sensory loss can influence the strength of the grip.

This study has investigated the comparison of dominant and nondominant hand grip and pinch strengths of healthy subjects and their relation with hand dominance. In accordance with recent studies, our results revealed stronger grip and pinch strengths at dominant sides for the whole group. Only 14.09% of our subjects had stronger nondominant hand grips. A similar picture was obtained for the right handed participants (10.93%) whereas the ratio of stronger nondominant hand was significantly higher for left handed group (33.33%).

Petersen et al analysed 48 left handed and 262 right handed subjects and found a significant difference between two groups⁽¹⁰⁾. 48% of left handed subjects had higher grip values at their nondominant side but this percentage was only 6.9% for right handed subjects.

A general rule often used suggests that the dominant hand is approximately 10% stronger than the nondominant hand^(10,11). Hence, this rule has not been confirmed in our study in correlation with some other studies⁽¹⁰⁻¹²⁾. 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⁽¹⁰⁾. Petersen et al questioned whether the 10% rule could be applied to the whole population^(10,11). They found that on average, grip strength in the dominant hand was 12.7 % stronger for right handed people. Left handed subjects showed no such difference between the dominant and nondominant hand.

In our right handed group, grip strength scores were 8.20% higher for dominant hand, whereas this percentage was 3.20% for our left handed subjects. So we are in agreement with recent studies suggesting that 10% rule cannot be generalised to the whole population. While interpreting these results we must take into account that the world we live in is mostly designed for right handedness. Most tools and daily appliances are designed for the right hand. As a result, the right hand of both right and left handed people is exercised more often than left on a daily basis⁽⁵⁾.

Pulp pinch measurements performed with manual pinchmeter were measured between the first and second digits of both hands. Pulp pinch is a positioning pinch used in activities requiring fine coordination rather than power. In our study, pinch strength values were significantly stronger at dominant sides. In total, 42 of 149 subjects (28.19%) were found to have at least equal or higher values for nondominant pulp pinch. The percentage of higher nondominant

pinch scores were 28.12% and 28.57% for right and left handers respectively. This similarity may be due to the fact that both hands are used for activities of daily living where fine coordination is required. The dominant hand is used mostly for strength requiring tasks. The data of this study indicate that there is less difference in the strength patterns of dominant and nondominant hands for pulp pinch values compared to hand grip.

CONCLUSION

We concluded that the dominant hand is significantly stronger in right handed subjects but no such significant difference between sides could be documented for left handed people. This difference may be attributed to the fact that left handed people are temporarily forced to use their nondominant hands for daily activities in this right hand dominant world.

REFERENCES

1. Balogun JA, Akomolafe CT, Amusa LO. Grip strength: Effects of testing posture and elbow position. *Arch Phys Med Rehab* 1991; 72:280-3.
2. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: Normative data for adults. *Arch Phys Med Rehab* 1985; 66:69-74.
3. Schmidt RT, Toews J.V. Grip strength as measured by the Jamar dynamometer. *Arch Phys Med Rehab* 1970; 51:321-7.
4. Lagerstrom C, Nordgren B. On the reliability and usefulness of methods for grip strength measurement. *Scand J Rehab Med* 1998; 30:113-9.
5. Crosby CA, Wehbe MA, Mawr B. Hand strength: normative values. *J Hand Surg* 1994; 19A:665-70.
6. Hunter JM, Mackin EJ, Callahan AD, editors. *Rehabilitation of the hand: Surgery and therapy*. Missouri: Mosby 1995.
7. Kuzala EA, Vargo MC. The relationship between elbow position and grip strength. *Am J Occup Ther* 1992; 46:509-12.
8. Richards L, Olson B, Palmiter-Thomas P. How forearm position affects grip strength. *Am J Occup Ther* 1996; 50:133-9.
9. Bohannon RW. Reference values for extremity muscle strength obtained by hand-held dynamometer from adults aged 20 to 79 years. *Arch Phys Med Rehab* 1997; 78:26-32.
10. Petersen P, Petrick M, Connor H, Conklin D. Grip strength and hand dominance: challenging the 10% rule. *Am J Occup Ther* 1989; 43:444-7.
11. Armstrong CA, Oldham JA. A comparison of dominant and non-dominant hand strengths. *J Hand Surg* 1999; 24B(4):421-5.
12. Reikeras O. Bilateral differences of normal hand strength. *Arch Orthop Trauma Surg* 1983; 101:223-4.