Journal of Hand Therapy 29 (2016) 483–488

Contents lists available at ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

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Scientific/Clinical Article

Comparative study of millennials' (age 20-34 years) grip and lateral pinch with the norms

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ARTICLE INFO

Article history:
Received 16 September 2015
Received in revised form
14 December 2015
Accepted 27 December 2015
Available online 11 January 2016

Keywords:
Grip strength
Lateral pinch strength
Millennials
Normative data

ABSTRACT

Study Design: Cross-sectional research design.
Introduction: Clinical practice continues to use normative data for grip and pinch measurements that were established in 1985. There is no updated norms despite different hand usage patterns in today's society.
Purpose of the Study: Measuring and comparing grip and pinch strengths with normative data is a valid method to determine hand function. This research was implemented to compare the grip and pinch measurements obtained from healthy millennials to the established norms and to describe hand usage patterns for millennials.
Methods: Grip and lateral pinch measurements were obtained from a sample of 237 healthy millennials (ages 20-34 years).
Results: Strength scores were statistically lower that older normative data in all millennial grip strengths, with the exception of the women in the age group of 30-34 years. Specifically, this statistically significant trend was observed in all male grip strengths, as well as in women in the age group of 20-24 years (bilateral grip) and 25-29 years (right grip). However, the lateral pinch data reflected was similar to the older norms with variances of 0.5-1 kg.
Conclusion: Current data reflect statistically significant differences from the norms for all male grip measurements, as well as for women in the age group of 20-24 years (bilateral grip) and 25-29 years (right grip). No statistical significance was observed in the independent-sample *t* tests for the lateral pinch in men of all age groups. Statistical significance was noted for lateral pinch for female age groups for the left hand (20-24 years) and for bilateral lateral pinches (30-34 years).
Level of evidence: IV.

Introduction

Grip and pinch strength measurements are routinely assessed to evaluate upper extremity impairments, strength changes, and work capacity or demands. Grip strength testing provides information on hand function and can be used as a predictor for treating hand injuries and related conditions, as well as determining illness and disability risk factors.[1–7] Strength measurements are quick assessments that yield pertinent clinical data to be used in the rehabilitative remediation process. These data have acceptable reliability and validity, which is valuable for clinical reasoning in the determination of functional impairments and functional progress. Due to the fact that the norms for grip and pinch were established in 1985 and have not been updated despite changes in work demands and technological advancements, it is relevant to investigate whether older normative data for the current young generation (ie, millennial generation).[8] The millennial population includes individuals born after 1980 who have a high frequency of technology use in everyday work, play, and leisure activities. Therefore, it is important to focus on this population when re-evaluating the grip and pinch norms to determine whether current societal and work changes and increased technology use may have affected grip and pinch strength values.[9]

To ensure norm validity, it is recommended that the norms be updated every 10-20 years according to Stringer and Naldone.[10] Several articles on pinch and grip strength suggest that therapists require an updated set of norms for assessments to be accurate.[10,11] In the health care field, there is an evidence-practice gap where evidence formulated from research has not been up to date with the needs of current health care practice.[12] The study by Mullerpatan et al[13] indicated that the United States uses the most

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http://dx.doi.org/10.1016/j.jht.2015.12.006

outdated normative data from 1985 in comparison to normative data used in the regions of Switzerland, Taiwan, Australia, and Iran that have all been established or reestablished since 2006. Due to the lack of more current normative data, some health care professionals are using nonstandardized assessments to interpret grip and pinch strengths. Because these assessments are not evidence based, this does not reflect the vision toward which the occupational therapy profession is moving.[14] As a result, research studies such as the proposed grip and pinch study are important to provide data for evidence-based practice. Therapists need current evidence in practice to be able to obtain accurate assessments and provide appropriate interventions for their clients.

Grip and pinch norms should also be updated due to changes in societal trends potentially rendering the previous norms obsolete. One trend is the shift away from physical labor toward more sedentary jobs. It has been reported that from 1910 to 2000, there were major changes in the American workforce. The top areas to decline were in manufacturing and agriculture, whereas areas to increase dealt with technology-related jobs.[15] This trend is particularly important due to its potential effect on grip strength, as research has supported that grip strength varies depending on the physical and strenuous nature of the activities a person engages in daily.[16] Along with this decrease in daily strenuous activities, there has been an increase in technology use in work and everyday activities, with three-fourths of adults using a laptop/personal computer and most American adults using a smartphone in their work and leisure tasks.[17] Therefore, these shifts in societal and work demands could affect current pinch and grip strength norms.

Overall, the literature review suggests that grip and pinch strength norms need to be updated due to changes in societal trends potentially affecting pinch and grip strength. Updating the grip and pinch norms will ensure health care professionals can accurately assess their clients' hand function.

Purpose

The purpose of this study was to determine whether there are differences in grip and pinch strengths comparing a sample of healthy millennials (ages 20-34 years) with the Mathowietz (1985) age- and sex-matched norms.

Methods

Design and setting

A nonexperimental cross-sectional research design with data collected over 1 semester was used in this quantitative study because the recruitment of participants included a convenience sample that was not randomized, controlled, or manipulated.[18]

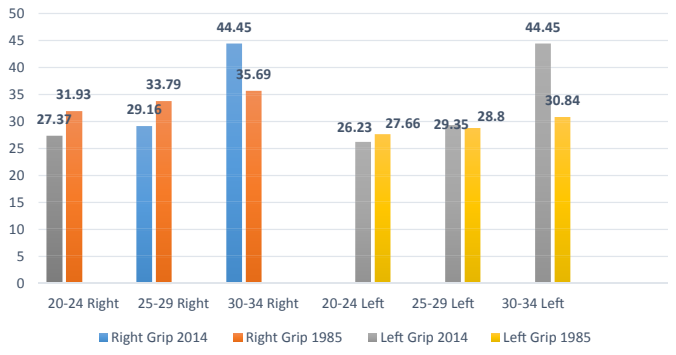

Fig. 1. Comparison of female grips in kilograms to the norms.

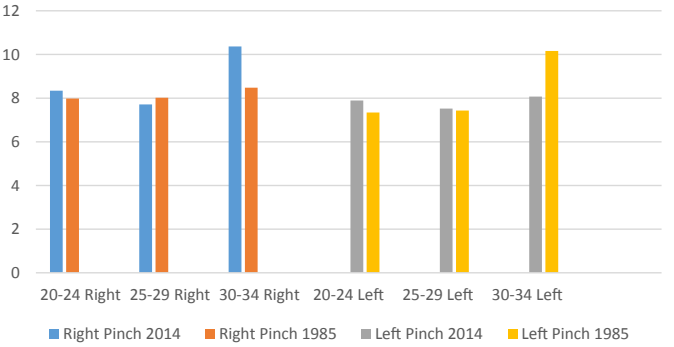

Fig. 2. Comparison of female lateral pinch in kilograms to the norms.

Participants were full-time students aged 20-34 years (millennials' age group), totaling 237 participants with 154 being women and 83 being men. Participants were recruited at university settings in North Carolina. All participants received instructions and provided consent before initiation of the study. Participants completed a questionnaire to provide demographic information; however, no further information was obtained due to participants reporting being full-time students with assumed similar roles/daily activities. Questions relating to any history of upper extremity pathology/injury or recurrent pain were also included before the participants' inclusion in the study. If prior upper extremity pain or injury that indicated potential residual impairments or pathology was disclosed, these individuals were excluded from the data collection sample. The Finkelstein test was also administered to exclude participants with possible thumb conditions or injuries affecting pinch strength, which is especially significant in this population due to the increased prevalence of repetitive stress activities such as texting. It was not determined to be necessary to evaluate more specifically for other types of tendonitis as these participants were excluded from the study to prevent potential influences on the data being compared to the 1985 Mathowietz normative data.

Procedures

The Jamar hydraulic hand dynamometer was obtained from Sammons Preston, Boling Brook, Illinois and used to assess handgrip strength, and the B&L Engineering pinch gauge was used to assess lateral pinch strength. Instruments were calibrated before initiation of the study. Calibrations were conducted by a master service technician per manufacturer guidelines using force gauges and adjustment of readings as indicated. Testing with both instruments was conducted according to the American Society of

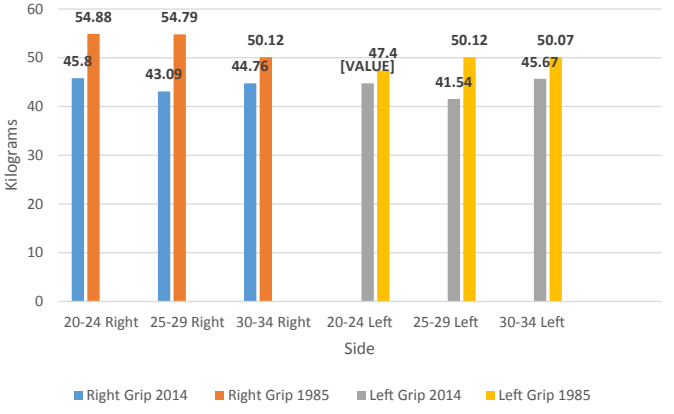

Fig. 3. Comparison of male grip in kilograms to the norms.

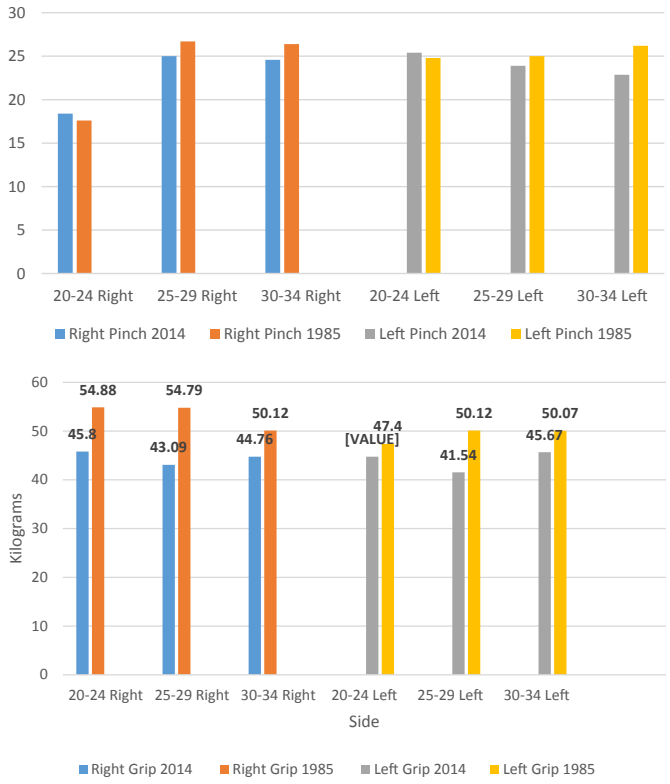

Fig. 4. Comparison of male lateral pinch to the norms.

Hand Therapists (ASHT) protocol[19] and the study by Mathiowetz et al.[20] These measurements were obtained with the client sitting with the shoulder adducted, the elbow flexed at 90°, the forearm in a neutral position, and the wrist between 0° and 30° dorsiflexion when assessing grip and pinch strengths with the dynamometer or the pinch gauge as indicated in the ASHT protocol.[19] The researchers held the dynamometer with the strap around their wrist and the hand on the readout dial. The pinch gauges were held at the distal end for securing the gauge during data collection. The dynamometer handle was set at the second handle position for all participants for standardization. Grip and lateral pinch strengths were measured 3 times bilaterally and then individually averaged to find the overall grip and pinch strength score for each hand according to the protocol reported by King.[21] High validity, inter-rater reliability, and test-retest reliability have been established for both the Jamar dynamometer and the B&L Engineering pinch gauge when the ASHT positioning protocol is followed, and the mean of 3 trials is used as noted by Mathiowetz.[22] While current practice uses one-time measurements, the mean of 3 trials was used to be consistent with the Mathiowetz study. There were similar measurements noted for 1 measurement vs 3 trials. The lateral pinch test was the only pinch measurement obtained due to the similarity of hand usage for texting in millennials.

Data collection

Data collection was conducted in areas highly accessed by millennials, where permission was obtained to conduct research. A researcher invited individuals to take part in the study and provided a summary of the purpose of the study and expectations for participation. If the individual expressed interest in participating, a consent form was then provided to prevent liability of the researchers and university for any injuries, as well as to ensure participant confidentiality. A questionnaire was also given to all participants to collect demographic information for the participants' gender, age, hours and method of smartphone usage, and history of any upper extremity pain or injury. The grip and pinch strength data were then collected using the dynamometer and pinch gauge instruments for both the right and left upper extremity per ASHT protocol.

Results

This study population included a sample of 237 healthy millennials (ages 20-34 years). Data analysis was conducted using SPSS to determine the mean, standard deviation controlling for sex, age, and each hand grip and lateral pinch to obtain comparable data points as the study by Mathiowetz et al.[20] Data analysis controlling for these variables was done using the independent-samples *t* test in Excel.

Additional analysis of the pinch and grip strengths controlling for each age range was calculated and compared with the normative data from the study conducted by Mathiowetz et al.[20] For women of age 20-24 years, the average right grip strength was lower by 5.2 kg (11.4 lb) and the average left upper extremity grip strength was lower by 2.7 kg (6 lb). The average right upper extremity pinch strength was higher by 0.4 kg (0.8 lb), whereas the average left upper extremity pinch strength was higher by 0.5 kg (1.2 lb). For women of age 25-29 years, the average right upper extremity grip strength was lower by 3 kg (6.7 lb) and the average left upper extremity grip strength was higher by 0.6 kg (1.3 lb). The average right upper extremity pinch strength was lower by 0.3 kg (0.7 lb), and the average left upper extremity pinch strength was higher by 0.1 kg (2 lb). For women in the age group of 30-34 years, the average right upper extremity grip strength was higher by 1.5 kg (3.3 lb) and the average left upper extremity grip strength was higher by 4.3 kg (9.4 lb). The average right upper extremity pinch strength was higher by 1.6 kg (3.6 lb), whereas the average left upper extremity pinch strength was higher by 2.1 kg (4.6 lb) as noted in Figures 1 and 2.

Table 1
Average grip strength (kg) for both hands stratified by age and gender for norms (Mathowietz study, group 1) and (present study, group 2) and independent-samples *t* test

Age	Side	Male							Female						
		Group 1			Group 2			*P* value	Group 1			Group 2			*P* value
		Mean	SD	*N*	Mean	SD	*N*		Mean	SD	*N*	Mean	SD	*N*	
20-24	R	55.0	20.6	29	45.8	4.40	63	.00001	31.9	14.5	26	27.3	14.16	125	.00001
20-24	L	47.5	21.8	29	44.7	3.00	63	.000102	27.6	13.0	26	26.2	15.68	125	.27791
25-29	R	54.7	21.80	27	43.0	4.70	15	.0001	33.7	13.9	27	31.4	9.95	18	.15046
25-29	L	50.1	16.20	27	41.5	5.2	15	.00001	28.8	12.2	27	29.3	9.97	18	.71541
30-34	R	55.24	22.4	27	44.7	4.37	4	.000083	35.6	19.2	26	44.4	11.6	11	.00063
30-34	L	50.07	21.7	27	45.6	3.37	4	.03968	30.84	17.7	27	36.7	11.6	11	.01009

Statistically significant values for *P* value <.05.
SD = standard deviation.

Table 2
Average lateral pinch strength (kg) for both hands stratified by age and gender for norms (Mathowietz study, group 1) and (present study, group 2) and independent-samples *t* test with *P* value

Age	Side	Male							Female						
		Group 1			Group 2			*P* value	Group 1			Group 2			*P* value
		Mean	SD	*N*	Mean	SD	*N*		Mean	SD	*N*	Mean	SD	*N*	
20-24	R	11.7	20.6	29	11.5	3.0	63	.876	7.9	2.0	26	8.3	4.47	125	.1576
20-24	L	11.2	21.8	29	11.5	3.3	63	.8834	7.3	2.1	26	7.8	4.47	125	.0382
25-29	R	12.1	23.0	27	11.3	3.0	15	.7074	8.0	2.1	27	7.7	4.3	18	.5240
25-29	L	11.3	16.2	27	10.8	4.11	15	.7401	7.5	2.1	27	7.4	4.46	18	.8590
30-34	R	11.9	22.4	27	11.1	2.68	4	.6899	8.4	2.1	26	10.1	3.0	11	.00091
30-34	L	11.8	21.7	27	10.3	1.42	4	.4382	8.0	3.0	26	10.1	6.7	11	.03559

Statistically significant values for *P* value <.05.
SD = standard deviation.

For men in the age group of 20-24 years, the average right upper extremity grip strength was lower by 9.1 kg and the average left upper extremity grip strength was lower by 2.6 kg (5.8 lb). The average right upper extremity pinch strength was lower by 0.3 kg (0.6 lb) and the average left upper extremity pinch strength was lower by 0.3 kg (0.6 lb). For men in the age group of 25-29 years, the average right upper extremity grip strength was lower by 11.7 kg (25.8 lb) and the average left upper extremity grip strength was lower by 8.6 kg (18.9 lb). The average right upper extremity pinch strength was lower by 0.8 kg (1.7 lb), whereas the average left upper extremity pinch strength was lower by 0.5 kg (1.1 lb). For men in the age group of 30-34 years, the average right upper extremity grip strength was lower by 10.5 kg (23.1 lb) and the average left upper extremity grip strength was lower by 4.4 kg (9.7 lb). The average right upper extremity pinch strength was lower by 0.8 kg (1.7 lb), whereas the average left upper extremity pinch strength was lower by 0.5 kg (1.1 lb) as noted in Figure 2. Therefore, it is apparent that overall in most age groups, there was a lower grip strength, as well as a higher or comparable pinch strength noted in comparison to the study by Mathiowetz et al,[20] which could be attributed to the societal factors such as technology use and changes in workforce from physical labor to more technological, sedentary jobs (Figs. 3 and 4).

In summary, grip strength comparison of the study by Mathiowetz et al[20] to this study's results indicated lower means for all age groups for men and women, except for women in the age group of 30-34 years (n = 11) as noted in Figures 1 and 2. Lateral pinch strength comparison also yielded lower lateral pinch means in all male age groups in comparison to the study by Mathiowetz et al,[20] and a slight rise or similar pinch strength was observed in women of all age groups. Overall, comparison of the data conducted in this study with the norms data[20] published in 1985 yielded differences for all data points. Statistically significant *P* values were noted between the grip strength of all men. Statistically significant *P* values were noted for women aged 20-24 years for the right grip and 30-34 years for the bilateral grips as noted in Tables 1 and 2.

Limitation

Occupational roles were not measured or controlled for in this sample. Participants did report being full-time students, and the activities were assumed to be similar for the millennial age group.

The sampling from a university setting rather than the general population may have biased our results as we may have preferentially recruited people with more education, computer use and sedentary daily life roles than the general population.

Conclusion

The differences in the pinch and grip strengths for the millennial population from older norms suggests that some drift in the normal strength for young adults in the population may have occurred since the 1980's. This would support the need for large random samples from the population to be tested using more modern sampling, devices and test protocols. Current norms will allow health care professionals to more accurately assess impairment.

Numerous participants had to be excluded from data collection due to having a positive Finkelstein test. Although there may have been false positives, this suggests a potential upward trend of repetitive stress conditions in the millennial population. Hand therapists will need to be prepared to treat an increased number of clients with repetitive stress conditions and engage in the emerging focus on preventative care.

Acknowledgments

The authors greatly appreciate Anne Blosser, Cody Hamrick, Elizabeth Davis, and Anthony Dixon for their contributions to this study.

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Quiz: #446

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#1. The study design is
   a. RCTs
   b. case series
   c. prospective cohort
   d. cross sectional research

#2. The study sought to compare
   a. grip to pinch in a population of Millennials
   b. lateral pinch to three jaw chuck pinch in Millennials
   c. established norms to a population of Millennials
   d. grip and pinch in senior citizens to Millennials

#3. The test population typically performed more _____ than the established group
   a. technology use
   b. work from home tasks
   c. intellectually challenging work
   d. bilateral tasks at work

#4. The authors cite Stringer when suggesting norms be up-dated every
   a. 5-10 years
   b. 10-20 years
   c. 30 years
   d. 50 years

#5. The findings confirmed that both male and females had almost identical differences in comparing the established groups to the test groups
   a. true
   b. false

When submitting to the HTCC for re-certification, please batch your JHT RFC certificates in groups of 3 or more to get full credit.