The Relationship Between Hand Strength and the Forces Used To Access Containers by Well Elderly Persons

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Martin S. Rice

OBJECTIVE. This study extended previous work of Rice, Leonard, and Carter (AJOT, 52(8), 621–626) and examined the relationship between grip and pinch strengths and the forces produced while accessing common household containers in healthy, elderly persons.

METHOD. Forty-two women and 9 men 60 years of age and older were assigned randomly to one of four order groups in a counterbalanced, repeated-measures design. Grip strength was measured via a dynamometer and pinch strength via a pinch meter. The forces required to access six common household containers were measured with force sensing resistors applied to each container. Data analysis included Pearson product-moment correlations between the dependent variables of grip and pinch strength and force produced on the containers. Analyses of variance were used to determine differences by gender on the dependent measures and order of presentation of containers.

RESULTS. A fair relationship (r = .31 to .44) was found between grip and pinch strength and the ability to open three containers. Little or no relationship was found between grip and pinch strength and the ability to open the remaining three containers (r = −.03 to .25). Significant gender differences existed on overall strength and the force used to access two of the six containers. No order effects were found.

CONCLUSIONS. Strong relationships did not exist between the grip and pinch strength and the amount of force the elderly participants used to open the containers, which is similar to what Rice et al. found for younger persons. The participants appeared to use a greater proportion of their available strength when accessing the containers than did their younger counterparts previously studied. Further research is needed to determine at what level of weakness one would expect to see performance deficits in common daily occupations.


The proportion of elderly persons in the population is increasing as more people survive to old age. With the graying of the baby boom generation, this trend will accelerate in the 21st century. According to data from the U.S. Bureau of the Census (as cited by Resources Services Group, 1997), by 2030 an estimated 70 million older people will make up the U.S. population—more than twice their number in 1996. Therefore, therapists must understand elderly persons’ unique characteristics to help them maintain independence. This study investigated hand strength in well elderly persons and its relationship to their ability to open or use common household containers.

Occupational therapists have commonly used hand grip and pinch strengths as baseline measures to evaluate hand function (Mathiowetz, Weber, Volland, & Kashman, 1984). Nalebuff and Philips (1990) stated that grip strength of at least 20 lb and pinch strength of 5 lb to 7 lb are required to perform most occupations of daily living, but they did not specify the bases for these guidelines. Strength measurements are commonly combined with dexterity evaluations to provide a picture of hand function (McPhee, 1987). Assessing the broad range of typical daily living tasks is rarely practical, so testing a sample of tasks or self-reporting difficulties may
contribute to the evaluation. Little research guides therapists with regard to the amount of forces needed to accomplish a broad range of daily living tasks.

**Literature Review**

As the body ages, chronic disease or pathology may lead to impairments, and depending on severity, they may in turn lead to the inability to engage in desired occupations of daily living (Nagi, 1965). A person's ability to use his or her hands effectively in daily tasks depends on anatomical integrity, mobility, muscle strength, sensation, coordination, and motivation (McPhee, 1987).

Normal aging has certain effects on hand function. Several studies have compared the functional use of the upper extremity in large groups of elderly persons without disabilities to a reference group of younger persons (Aniansson, Rundgren, & Sperling 1980; Lundgren-Linquist & Sperling 1983; Sperling 1980). A longitudinal study examined the relationship of impairments to changes in daily living skills of persons 65 years of age and older (Jette, Branch, & Berlin, 1990). The researchers assessed a wide range of abilities, such as coordination; pinch and grip strength; hygiene and dressing; ability to function in the kitchen and community; and manual ability in common tasks, including use of electrical plugs, inserting and removing keys from locks, handling money, and dialing a phone.

The results revealed that the elderly participants showed a decline in manual dexterity, strength, and performance of functional tasks compared with younger participants. They found significant correlations between strength (especially in the key-pinich) and performance time in the tests of coordination and functional tasks such as handling an electrical plug. The participants experienced increased difficulty with daily occupations as a result of progression of upper-extremity and lower-extremity impairments.

Shiffman (1992) studied strength and prehension patterns of adults of differing ages and found that as age increased, hand strength decreased for all prehension patterns and performance time increased. However, many research design limitations may have influenced the outcome of this study. The sample size was small and nonrandomized; the reliability of the method to identify and analyze the prehension patterns was not tested; and the performance time was subjectively based.

Cole (1991) and Kinoshita and Francis (1996) have shown that older adults use greater force than younger adults when holding cylindrical weights of varying degrees of surface properties (smooth to rough textures). These researchers attributed these differences to a combination of age-related changes in skin properties, sensibility, and central nervous system function.

Keram and Williams (1988) compared the amount of time persons 60 years of age and older used to open 15 different types of medication containers. Participants could open all of the non–child-resistant containers but not all of the child-resistant containers. Differences were reflected in the amount of time required to open the containers, the proportion of participants able to open each container, and participants’ own ratings of the ease of use of various containers. Rogers, Meyer, Walker, and Fisk (1998) also found frustrations with opening small containers, particularly medicine bottles, in an ethnographic study of a group of healthy older adults.

Although many of these studies looked at functional tasks and the time taken to complete the tasks, few measured the grip forces needed to perform these tasks. Rice, Leonard, and Carter (1998) measured the amount of force required to open common household containers and ascertained whether a relationship existed between grip, lateral pinch, tip-to-tip pinch, and three-jaw chuck pinch dynamometry performance and the force exerted to open the containers. The participants were healthy college students 20 to 52 years of age. Force sensing resistors (FSRs) recorded the pressures exerted on six common household containers. Rice et al. found (a) little to no relationship between grip and pinch dynamometry performances and the forces generated in accessing these containers, (b) a significant difference between genders on all grip and pinch strengths but no significant difference between the genders in the force generated to open the containers, and (c) apparent preferred container opening strategies that were consistent over all trials. Relative to this third finding, the authors stated that the development of efficient grasp strategies might be more effective than enhancing strength in improving the ability to access containers. To develop such strategies, occupational therapists need to do task analyses of the container, the environmental context, task demands, and the motor strategy used (Conti, 1998). Efficient grasp strategies are especially relevant for older persons with whom decrements in hand function were found to be the most significant musculoskeletal mechanism causing disablement in basic occupations of daily living (Jette et al., 1990). Because accessing containers, especially medicine containers, has been identified as a problem for many elderly persons, a replication of Rice et al. with extension to a group of community-dwelling elderly persons is appropriate.

The purpose of this study was to examine the relationship between grip, lateral pinch, tip-to-tip pinch, and three-jaw chuck pinch performance and the force produced in accessing common household containers in an elderly population. The following null hypotheses are based on previous research (Rice et al., 1998):

- No relationship will be found between strength and force used to access containers.
• No differences will be found between men and women on the amount of force used to access containers.

Method

Participants

Fifty-one volunteers over 60 years of age comprised the sample. The participants were recruited from northwest Ohio senior centers, volunteer groups, and churches. The 42 women and 9 men self-reported to be in good health with no known neuromuscular or orthopedic conditions affecting their upper extremities to such an extent that their ability to open containers would be impaired.

Instruments

A Jamar® dynamometer was used to measure grip strength, and a B & L Engineering® pinch meter was used to measure pinch strength. Both the dynamometer and the pinch meter were calibrated before initiation of the study.

FSRs recorded the pressures exerted on six common household containers. They were calibrated before use and placed on predetermined areas of the containers, which Rice et al. (1998) identified as prime locations for finger and hand contact. The containers used in this study were as follows (see Figure 1):

• Dual-pinchesqueeze bottle
• Small prescription medicine bottle that required push-down and rotation movements
• Large prescription medicine bottle that required push-down and rotation movements
• Over-the-counter medicine bottle that required an alignment and pop-off motion for the lid
• Aerosol can of air freshener that required a single-hand ed operation (power grip combined with depression of a button by thumb or index finger)
• Trigger pump spray bottle that required a single-hand ed operation (power grip with one or more fingers used for the depression of the trigger)

Data from the FSRs interfaced with a 200 MHz P5-200 Gateway® desktop computer. Data were sampled at 60 Hz for 15 sec using a 16-bit KPCMCIA-16AI analogue-to-digital acquisition card® with Testpoint data acquisition software version 3.2B.®

Design

Participants were randomly assigned to orders of tasks using a counterbalanced, repeated-measures design; the counterbalancing was within and between the strength and force conditions. All participants experienced the same conditions, but the order of presentation differed according to their group assignment. Each participant experienced the following conditions: the hand grip dynamometer, lateral pinch meter, tip-to-tip pinch meter, three-jaw chuck pinch meter, the small prescription medicine bottle, the large prescription medicine bottle, dual-pinchesqueeze bottle, bottle with pop-off lid, trigger pump spray bottle, and aerosol spray can. Participants performed either the grip and pinch measurements or the force on the container measurements first, depending on their order assignment. The order of presentation was counterbalanced within the grip and pinch conditions (4) and the container conditions (6).

Procedure

The Institutional Review Board approved the study procedures, and before data collection, informed consent was obtained from the participants. Demographics of age, gender, and limb dominance also were collected.

Grip and pinch measurements for both limbs were obtained following the American Society of Hand Therapists standardized procedures as reported by Mathiowetz et al. (1984). A 30-sec rest period was provided between each of the three trials.

For the container-opening portion of the data collection, participants stood within a 1-ft square taped on the floor in front of a 32-in.-high table on which the containers were presented with a number designation. The researcher read the following verbal instructions, which were modified depending on the type of container being accessed: “I want you to pick up container number X and
open the container (or operate the mechanism). Repeat this three times.” Three trials were chosen to obtain a more accurate indication of performance.

Data Analysis

For grip and each type of pinch, the mean of the three trials was calculated. The FSR data were smoothed using digital signal processing with a 5-point window (Oppenheim & Schafer, 1975). Data reduction involved finding the maximum force for each trial for each FSR and averaging them. These means were used for all further analyses. Data were analyzed with SPSS for Windows software version 9.0 (Statistical Package for the Social Sciences, 1999).

Descriptive statistics were calculated for age, the proportion of men to women, grip and pinch strengths, and the force exerted on the containers. Frequency statistics revealed that very few participants touched the second FSR on the small medicine bottle; hence, too few trials were recorded to give an accurate representation of force exerted at this site across the sample, and this FSR was not included in further analyses. There were losses of trials for all containers. The percentage of FSRs participants did not apply any force to or for which we had technical difficulty were as follows: aerosol spray can, 7.8%; bottle with pop-off lid, 5.8%; small prescription medicine bottle, 15.6%; dual-pinch safety squeeze bottle, 11.8%; large prescription medicine bottle, 17.6%; and trigger pump spray bottle, 15.6%. These data were not included in the analyses of force on the containers.

A Pearson product-moment correlation was done between strength measurements and the mean forces used to open or operate each container. To interpret the strength of association between the variables, we followed Portney and Watkins’s (1993; pp. 442–444) guidelines, where correlations ranging from .00 to .25 indicate little or no relationship, .25 to .50 a fair degree of relationship, .50 to .75 a moderate to good relationship; and greater than .75 a good to excellent relationship. One-way analyses of variance (ANOVA) were performed on gender for the six FSRs and the grip and pinch strengths. One-way ANOVAs were performed on the six levels of order for the containers, the four levels of order for the grip and pinch strengths, and the two levels of order for the grip and pinch strengths and forces exerted on the containers.

Results

Participants ranged in age from 60 to 84 years (M = 71.9 years, SD = 6.4). Mean age was 72.1 years (SD = 6.7) for the women and 71.1 years (SD = 4.8) for the men. Descriptive statistics for grip and pinch strengths and the forces applied on the FSRs are shown in Table 1. The mean force values recorded by all FSRs ranged from 2.19 lb (SD = 2.08) for the small prescription medicine bottle to 9.76 lb (SD = 4.36) for the dual-pinch safety squeeze bottle. The means and standard deviations of grip and pinch strengths and force applied to each container by gender are shown in Table 2. The Pearson product-moment correlations between grip and pinch strengths and forces applied to the containers ranged from –.03 to .44 (see Table 3).

The one-way ANOVA on gender for grip and pinch strengths showed significant differences for all (see Table 4), with men averaging stronger grip and pinch measurements than women. The one-way ANOVA on gender for the six FSRs showed a significant difference between men and women for the aerosol spray can and the small prescription medicine bottle, with men using more force than women (see Table 5). No significant order of presentation effects were found within the containers, within the grip and pinch measurements, or between the grip and pinch measurements and forces exerted on the containers.

Discussion

The purpose of this study was to replicate and extend Rice et al.’s (1998) examination of the relationship between grip and pinch strengths and the forces used to access common household containers in a group of college students. Rice et al. found little to no relationship between grip and pinch strengths and forces generated in accessing the majority of containers. They did find slightly stronger relationships between pinch strengths and the ability to open the bottle with pop-off lid, the small prescription medicine bottle, and the large prescription medicine bottle. These researchers concluded that greater hand strength did not afford greater performance in opening and accessing selected containers.

Based on Rice et al.’s (1998) findings, we predicted that no relationship would be found between the grip and pinch strengths and the forces used to operate or open common household containers in a healthy elderly population. Using Portney and Watkins’s (1993) nomenclature, our results indicated that for four of the six containers, little to no relationship existed between grip strength and the forces used to open the containers successfully. A fair relationship was found between grip strength and the forces used to open the large prescription medicine bottle and to operate the aerosol spray can. The results also indicated that for three of the six containers, little or no relationship existed between pinch strength and the force used to access the containers’ operating mechanisms. A fair relationship was found between pinch strength and the force used to open

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the dual-pinch safety squeeze bottle and large prescription medicine bottle and to operate the aerosol spray can. In the few cases where fair degrees of relationships were found, no correlation exceeded .44.

These results indicate that with few exceptions, elderly participants demonstrated a similar pattern to their younger counterparts. Little relationship was found between grip and pinch strengths and the amount of force the participants used to open or access the containers included in this study. However, a comparison of the magnitude of the correlations found in the two studies reveals that the majority of correlations for the well elderly participants were somewhat larger than the same correlations for the younger group. Because grip strength was less for the elderly participants (particularly for the women), the relationship between grip strength and forces needed to open the containers was higher. Given that the elderly participants did not have notable strength deficits for their ages, one could hypothesize that clients with impaired hand strength would require a higher proportion of their maximum strength to open containers. At some level of weakness, participants would be unable to open the containers. Further studies could attempt to pinpoint the level of strength that would be associated with the inability to open or use common containers.

The highest correlations in this study were between the lateral and three-jaw chuck pinch strengths and the force used to open the dual-pinch safety squeeze bottle. These somewhat stronger relationships may result from the similarity of these pinches to those required to open this kind of bottle. Operating the dual-pinch mechanism requires only two digits, and total force used for grasping and holding a cylinder has been shown to increase as the number of digits involved decreases (Kinoshita, Murase, & Bandou, 1996).

Also based on Rice et al.’s (1998) findings, we predicted that no differences exist between men and women in the amount of force used to access containers. Our results showed that for four of the six containers, there were no significant gender differences in the amount of force used to access them. For the aerosol spray can and the small prescription medicine bottle, the men used significantly more force than the women; thus, the second hypothesis was partially supported. Rice et al. did not find a significant gender difference in the amount of force applied to access these same containers.

Many of the studies cited previously found that decreases in hand strength with normal aging and age-related changes were related to decreased functional performance in occupations requiring strength or dexterity or both. In this study, we found that a decrease in the hand strength of the female participants and decreases in pinch strength in the male participants compared with the college-age population in Rice et al. (1998). It should be noted

Table 1. Grip and Pinch Strength and Forces Applied on the Sensors

<table>
<thead>
<tr>
<th>Dynamometry</th>
<th>(n)</th>
<th>(M)</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Range</th>
<th>Skew</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right hand</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip</td>
<td>51</td>
<td>60.05</td>
<td>21.42</td>
<td>30.00</td>
<td>121.67</td>
<td>91.67</td>
<td>1.36</td>
</tr>
<tr>
<td>Lateral</td>
<td>51</td>
<td>14.92</td>
<td>4.09</td>
<td>9.33</td>
<td>25.67</td>
<td>16.33</td>
<td>1.15</td>
</tr>
<tr>
<td>Three-jaw chuck</td>
<td>51</td>
<td>13.32</td>
<td>3.51</td>
<td>7.33</td>
<td>23.00</td>
<td>15.67</td>
<td>0.85</td>
</tr>
<tr>
<td>Tip-to-tip</td>
<td>51</td>
<td>10.38</td>
<td>3.81</td>
<td>3.33</td>
<td>22.00</td>
<td>18.67</td>
<td>1.21</td>
</tr>
<tr>
<td><strong>Left hand</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip</td>
<td>51</td>
<td>51.73</td>
<td>20.22</td>
<td>20.00</td>
<td>113.33</td>
<td>93.33</td>
<td>1.58</td>
</tr>
<tr>
<td>Lateral</td>
<td>51</td>
<td>13.79</td>
<td>4.19</td>
<td>6.67</td>
<td>27.00</td>
<td>20.33</td>
<td>0.90</td>
</tr>
<tr>
<td>Three-jaw chuck</td>
<td>51</td>
<td>12.58</td>
<td>3.76</td>
<td>5.33</td>
<td>24.00</td>
<td>18.67</td>
<td>0.88</td>
</tr>
<tr>
<td>Tip-to-tip</td>
<td>50</td>
<td>9.85</td>
<td>3.79</td>
<td>2.00</td>
<td>21.33</td>
<td>19.33</td>
<td>1.02</td>
</tr>
<tr>
<td><strong>Container</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerosol</td>
<td>47</td>
<td>5.68</td>
<td>3.10</td>
<td>1.16</td>
<td>12.00</td>
<td>10.84</td>
<td>0.53</td>
</tr>
<tr>
<td>Pop-off lid</td>
<td>48</td>
<td>3.93</td>
<td>2.21</td>
<td>0.66</td>
<td>9.43</td>
<td>8.77</td>
<td>0.70</td>
</tr>
<tr>
<td>Small medication</td>
<td>43</td>
<td>2.19</td>
<td>2.08</td>
<td>0.14</td>
<td>8.10</td>
<td>7.95</td>
<td>1.49</td>
</tr>
<tr>
<td>Dual-pinch</td>
<td>45</td>
<td>9.76</td>
<td>4.36</td>
<td>0.24</td>
<td>18.58</td>
<td>18.33</td>
<td>0.90</td>
</tr>
<tr>
<td>Large medication</td>
<td>42</td>
<td>7.13</td>
<td>5.04</td>
<td>0.68</td>
<td>19.96</td>
<td>19.28</td>
<td>0.93</td>
</tr>
<tr>
<td>Trigger pump</td>
<td>43</td>
<td>8.04</td>
<td>4.71</td>
<td>0.16</td>
<td>17.61</td>
<td>17.57</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Note. Unit of measure is pounds.*

Table 2. Grip and Pinch Strength and Forces on Containers by Gender

<table>
<thead>
<tr>
<th>Dynamometry</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Right hand</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip</td>
<td>97.96</td>
<td>18.74</td>
</tr>
<tr>
<td>Lateral</td>
<td>22.07</td>
<td>3.14</td>
</tr>
<tr>
<td>Three-jaw chuck</td>
<td>18.30</td>
<td>3.66</td>
</tr>
<tr>
<td>Tip-to-tip</td>
<td>16.22</td>
<td>4.20</td>
</tr>
<tr>
<td><strong>Left hand</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip</td>
<td>83.33</td>
<td>26.00</td>
</tr>
<tr>
<td>Lateral</td>
<td>20.37</td>
<td>3.60</td>
</tr>
<tr>
<td>Three-jaw chuck</td>
<td>17.48</td>
<td>4.37</td>
</tr>
<tr>
<td>Tip-to-tip</td>
<td>15.60</td>
<td>3.84</td>
</tr>
<tr>
<td><strong>Containers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerosol</td>
<td>7.93</td>
<td>3.21</td>
</tr>
<tr>
<td>Pop-off lid</td>
<td>4.56</td>
<td>2.91</td>
</tr>
<tr>
<td>Small medication</td>
<td>3.60</td>
<td>2.42</td>
</tr>
<tr>
<td>Dual-pinch</td>
<td>11.38</td>
<td>5.04</td>
</tr>
<tr>
<td>Large medication</td>
<td>9.98</td>
<td>5.62</td>
</tr>
<tr>
<td>Trigger pump</td>
<td>9.07</td>
<td>4.55</td>
</tr>
</tbody>
</table>

*Note. Unit of measure is pounds.*
that the participants in our study had strength measurements within normal limits for their age groups. Their reduced hand strength did not prevent them from being able to open the containers. For persons with significantly weaker grip or pinch strength, the results could have been quite different.

Keram and Williams (1988) found significant differences in the amount of time older persons required to open medicine containers and that some could not open all of the child-resistant containers. Three types of medicine containers were similar to the containers in our study, but we did not observe any inability to open containers. The participants in Keram and Williams’s study were slightly older (mean age = 75.3 years vs. 72 years), which may account for the difference in findings. Additionally, timing the participants while they opened the containers may have placed additional stress upon them, which could be reflected in their poorer performance.

As a group, our participants generated less force while opening the containers than did Rice et al.’s (1998) younger participants. In addition, our female participants consistently applied less average force to open and operate all containers than did the men. However, the maximum forces recorded by all individual FSRs in this study ranged from 8.1 lb on the small prescription medicine bottle to almost 20 lb on the large prescription medicine bottle—well over the minimum forces used to open the containers. We assumed that this difference was due to the use of available slack capacity, although greater force was not required to open or operate the containers successfully. Kinoshita and Francis (1996) reported that the use of slack capacity is similar to the use of a greater “safety margin” of grip force by older versus younger persons. If repeated over many daily occupations, these excessive forces could be a source of cumulative strain on the hands and wrists. Occupational therapists may note this tendency and suggest that clients modify their technique to use their hands more gently and efficiently. For example, a client may obtain better counter-pressure while opening a container with both hands or by resting the container on a surface.

Limitations

A limitation in this study was that we did not consider participants’ anthropometric variables, such as hand and finger dimensions. These variables may have had an effect on grip strategies and force-exerting capabilities. Therefore, our results cannot be generalized to containers of different dimensions or operating mechanisms. Caution is advised in generalizing the results to elderly men because the number of male participants in this study was low. As in the Rice et al. (1998) study, the presence of the sensors created an atypical container that could influence natural grasp. The sen-

Table 3. Pearson Product-Moment Correlations Between Grip and Pinch Strengths and Force Used to Open Containers

<table>
<thead>
<tr>
<th>Dynamosetry</th>
<th>Grip</th>
<th>Lateral</th>
<th>Three-Jaw Chuck</th>
<th>Tip-to-Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Dual-pinch</td>
<td>.27</td>
<td>.28</td>
<td>.43*</td>
<td>.43*</td>
</tr>
<tr>
<td>Small medication</td>
<td>.09</td>
<td>.03</td>
<td>.18</td>
<td>.12</td>
</tr>
<tr>
<td>Pop-off lid</td>
<td>.11</td>
<td>.06</td>
<td>.08</td>
<td>.07</td>
</tr>
<tr>
<td>Aerosol</td>
<td>.39*</td>
<td>.40*</td>
<td>.31*</td>
<td>.24</td>
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<tr>
<td>Trigger pump</td>
<td>.19</td>
<td>.20</td>
<td>.25</td>
<td>.12</td>
</tr>
<tr>
<td>Large medication</td>
<td>.32*</td>
<td>.39*</td>
<td>.24</td>
<td>.33*</td>
</tr>
</tbody>
</table>

*p ≤ .05.
sons were unable to open common containers. Upper-extremity weakness, to determine at what point per-
clinical populations with age-related disabilities, including
container. It would be beneficial to extend this study to
unrelated to the amount of force required to operate the
its ease of use. Perhaps subjective perceptions of ease of use
force advocated by Nalebuff and Philips (1990). These par-
mon types of containers.
pose problems in successfully opening and operating com-
would indicate that further decrements in strength may
et al. (1998). If this trend is supported in future research, it
men used greater force than the women on two of the six
containers. On average, the participants did not demon-
these tasks compared with the younger participants in Rice
use of the hand, including the minimum grip and pinch
forces needed for functional hand use and the efficiency of
various prehension strategies. Studies could include subjec-
tive measures of ease of opening the containers. In this
study, the dual-pinch safety squeeze bottle required the
most average force, but many participants commented on
its ease of use. Perhaps subjective perceptions of ease of use
are unrelated to the amount of force required to operate the
container. It would be beneficial to extend this study to
clinical populations with age-related disabilities, including
upper-extremity weakness, to determine at what point per-
sions existed in the amount of force applied to open these
containers. On average, the participants did not demon-
strate strong relationships between grip and pinch strength
and the forces used to open and operate the containers. The
men used greater force than the women on two of the six
containers. A trend does appear toward elderly persons
using a greater proportion of their available strength during
these tasks compared with the younger participants in Rice
et al. (1998). If this trend is supported in future research, it
would indicate that further decrements in strength may
pose problems in successfully opening and operating com-
mon types of containers. ▲

Directions for Future Research

On average, three of the six containers required more than
the 5 lb to 7 lb of pinch force but less than the 20 lb of grip
force advocated by Nalebuff and Philips (1990). These par-
ticular pinch guidelines may not be sufficient for all com-
mon daily living tasks. It would be interesting to continue
to explore the relationship between strength and functional
use of the hand, including the minimum grip and pinch
forces needed for functional hand use and the efficiency of
various prehension strategies. Studies could include subjec-
tive measures of ease of opening the containers. In this
study, the dual-pinch safety squeeze bottle required the
most average force, but many participants commented on
its ease of use. Perhaps subjective perceptions of ease of use
are unrelated to the amount of force required to operate the
container. It would be beneficial to extend this study to
clinical populations with age-related disabilities, including
upper-extremity weakness, to determine at what point per-
sions existed in the amount of force applied to open these
containers. On average, the participants did not demon-
strate strong relationships between grip and pinch strength
and the forces used to open and operate the containers. The
men used greater force than the women on two of the six
containers. A trend does appear toward elderly persons
using a greater proportion of their available strength during
these tasks compared with the younger participants in Rice
et al. (1998). If this trend is supported in future research, it
would indicate that further decrements in strength may
pose problems in successfully opening and operating com-
mon types of containers. ▲

Conclusion

The purpose of this study was to explore the relationships
between the grip and pinch strengths and the forces used to
open or operate common household containers in a well
elderly population and to determine whether gender differ-
ces existed in the amount of force applied to open these
containers. On average, the participants did not demon-
strate strong relationships between grip and pinch strength
and the forces used to open and operate the containers. The
men used greater force than the women on two of the six
containers. A trend does appear toward elderly persons
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Implementing the Well Elderly Program

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Integrate the concepts of the University of Southern California’s landmark Well Elderly Study, which determined that preventive occupational therapy greatly enhances the health and quality of life of independent living older adults. These ideas can be applied in numerous settings with other populations as well. The text outlines the steps for a successful OT intervention program with a focus on lifestyle redesign, and encourages readers to incorporate their own self-reflections as health care providers. Also provides other resources.

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