Original Article
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Reliability and Validity of the Martin Vigorimeter for Grip Strength Measurement in Korean Adults

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Background: Grip strength is important for fine motor skills, and one of the measurement tools for grip strength is the Martin Vigorimeter (MV) dynamometer. Studies on establishing the reliability and validity of the MV in Koreans are limited. We aimed to establish the reliability and validity of the MV for grip strength measurement in healthy Korean adults by comparing it with the Jamar dynamometer, the standard tool used by the American Society of Hand Therapists.

Methods: In total, 99 healthy participants (50 men and 49 women) were enrolled. Grip strength was measured using the Jamar dynamometer and MV. Reliability and validity were assessed using the intraclass correlation coefficient (ICC) and minimal detectable change (MDC). The correlation between the measurements of the instruments was analyzed using Pearson's correlation. The effect of hand anthropometry was evaluated, and the conversion equation between the instruments was calculated.

Results: MV showed excellent reliability (ICC > 0.90, $p < 0.001$) and validity with a high correlation ($0.7 \le r < 0.9$) with the Jamar dynamometer. The MDC was acceptable for detecting minimal clinically important differences (< 19.5%) in both instruments (Jamar: 3.4%–6.7%, MV: 3.8% to 6.3%). The grip strength measured using the MV was independent of hand anthropometry, unlike that using the Jamar dynamometer.

Conclusions: This study provides insights into the relationship between the Jamar and MV instruments for measuring grip strength in Koreans. The MV is a viable alternative to the Jamar dynamometer in Koreans, offering not only reproducible and reliable measurements of grip strength but also the advantage of being unaffected by variations in hand anthropometry.

Keywords: *Hand strength, Grip strength, Muslce strength dynamometer, Jamar, Martin Vigorimeter*

Grip strength is crucial for achieving fine motor skills and is evaluated by measuring the force administered by the hand holding an object.[1] It is used as a diagnostic tool in various clinical situations and can be easily measured using dynamometers.[1] Among the various types of dynamometers available, Jamar dynamometers and their variants (Jamar) are the most commonly used (Fig. 1)[2] because they are considered the standard tool by the American Society of Hand Therapists (ASHT).[3]

The Jamar and its variants use a sealed hydraulic system to measure grip strength that is displayed in either pounds or kilograms on an analog readout dial. The device is equipped with 2 handles and the distance between the handles can be adjusted to accommodate different hand sizes at 5 different positions. The reliability and validity of the Jamar have been established in numerous studies.[2] However, Jamar may not be the optimal tool in certain populations, such as older individuals with arthritis or those with weak muscle force.[2-6] Additionally, the heavy weight and rigid handle of the instrument can cause dis-

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Fig. 1. Jamar Dynamometer. The Jamar and its variants use a sealed hydraulic system to measure grip strength displayed in either pounds or kilograms on an analog readout dial. The device is equipped with 2 handles and the distance between the handles can be adjusted to accommodate different hand sizes at 5 different positions. One of the handles is curved to fit the hand and the other handle position (black arrow) is used in this study, as recommended by the American Society of Hand Therapists guidelines.[3)]

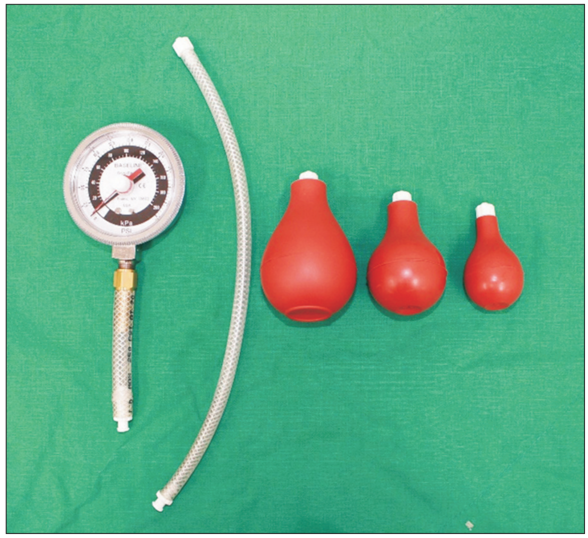

Fig. 2. Martin Vigorimeter (MV) dynamometer. MV is a device that measures grip strength by quantifying air pressure. It comprises a rubber balloon connected to a manometer via a rubber tube and reads grip strength in kilopascals per square centimeter. The MV is generally available with 3 different sizes of balloons, with the smallest bulb used to assess the grip strength in children and larger bulbs used for adults. The total weight of the MV is approximately 170 g. The largest bulb was used in this study since a previous study reported the highest correlation between the second handle of the Jamar and the largest bulb of the MV.

comfort and interfere with grip strength measurements.[2)]

In such cases, the Martin Vigorimeter (MV) dynamometer may be a better option (Fig. 2), because it measures pressure through a rubber bulb, with less force required, thus reducing the risk of pain.[7)] MV measures grip strength by quantifying air pressure. It consists of a rubber balloon connected to a manometer via a rubber tube and reads grip strength in kilopascals per square centimeter. The total weight of the MV is approximately 170 g, which is lighter than Jamar.

Few studies have been conducted on the reliability and validity of the MV, and most of them have been conducted on Caucasians and aging individuals.[7-9)] Although Park et al.[10)] reported normative data on grip strength in Koreans aged between 21–31 years using MV in 1993, we could not find further studies evaluating the reliability and validity of the MV by comparing it with another dynamometer in Koreans. Therefore, this study aimed to evaluate the reliability and validity of the MV for grip strength measurement by comparing it with the Jamar among healthy adults in the Korean population. Additionally, the correlation between anthropometric factors and grip strength was analyzed separately for both dynamometers.

METHODS

The local Ethics Committee of Chungnam National University Sejong Hospital approved the study protocol (IRB No. 2022-07-022-002) and all participants provided written informed consent before participating in the study. This study was performed according to the World Medical Association Declaration of Helsinki.

Participants and Study Design

Healthy participants aged 20–60 years, who were working at our hospital, were recruited for this study between September 2022 and November 2022. Recruitment was conducted using advertisements on websites and posters. For their participation, individuals were compensated with 20,000 KRW (approximately 15 USD) per visit. Previous data[8)] were used to determine the minimum number of participants required for the study. A sample size of 13 was needed for the correlation between the Jamar and MV with a power of 0.95, $r = 0.86$, and alpha = 0.05. For the correlation between hand anthropometric factors and grip strength, a sample size of 30 was required, with a power of 0.95, $r = 0.49$, and alpha = 0.05. To counteract the dropout rate, 50 men and 50 women were recruited for the study.

Participants with any hand disorders, injury, pain, or discomfort that could potentially affect grip strength were excluded.

Anthropometrical Measurement

The weight and height of the participants were recorded using an electronic scale and a height-measuring device (stadiometer). Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). To evaluate specific anatomical conditions, hand span, palm length, and arm span were measured for all participants on both hands. Grip span was determined by measuring the distance between the tips of the thumb and the little finger, with the fingers spread as wide as possible (Fig. 3A).[11] Palm length was measured as the distance between the midline of the distal wrist crease and the tip of the middle finger (Fig. 3B).[12] To determine the arm span, the circumference of the largest part of the forearm was measured at the proximal forearm (Fig. 3C).[12] The measurement accuracy was within 0.5 cm, and the results were rounded to the nearest centimeter. The dominant hand of each participant was defined as that used for writing.

Grip Strength Measurement

Grip strength was measured using both the Jamar and the MV. Participants were seated with their upper arms in a neutral position and the elbow at 90° flexion, and their forearms were held in a neutral position with the wrist at 0 to 30° extension according to the ASHT guidelines (Fig. 4).[3] The Jamar dynamometer features 2 handles, one of which is ergonomically designed to fit the hand, while the other offers 5 adjustable positions to accommodate hand size. Since the ASHT guidelines recommend the second handle as a standard position, which yields the strongest grip strength,[3,13] our grip strength assessments were conducted using the second handle setting on the Jamar dynamometer. The MV is generally available in 3 different sizes of balloons, with small, medium, and large sizes. For MV, the largest bulb was used in this study since a previous study reported the highest correlation between the second handle position of the Jamar and the largest bulb of the MV and generally used the largest bulb in adults.[7-9,14] To minimize muscle fatigue, rest periods of 1 minute were provided between successive attempts.[3]

Grip strength measurements were repeated in triplicate on each side, and the order of measurements was rotated among participants to avoid systematic errors. Test-retest reliability was assessed after 3 weeks in the same measurement sequence. The instruments (Jamar and MV) were newly purchased and calibrated according to the manufacturer's guidelines before conducting the tests.

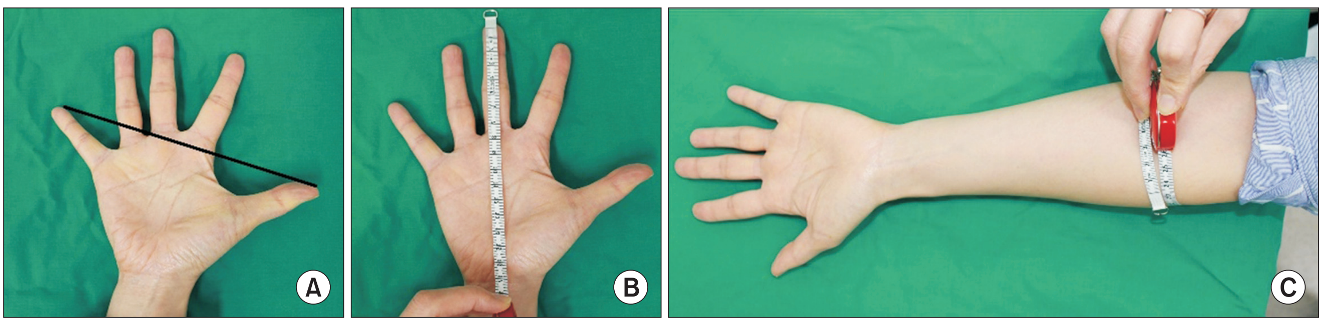

Fig. 3. Measurement of hand anthropometry with a precision within 0.5 cm. (A) Measurement of the grip span. (B) Measurement of the palm length. (C) Measurement of the arm span.

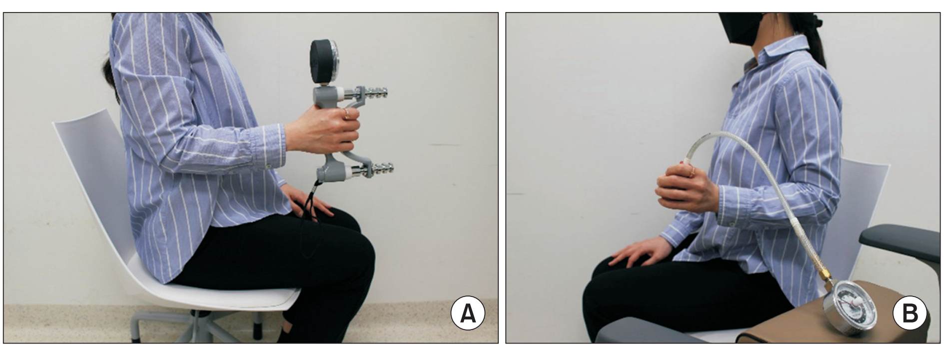

Fig. 4. Position of the participant during the measurement of grip strength. (A) Jamar dynamometer. (B) Martin Vigorimeter.

Grip strength was recorded in kilograms for the Jamar and kPa for MV.

Statistical Analysis

The characteristics of the participants are described using mean ± standard deviation (SD). The normalization of the data was analyzed using the Kolmogorov-Smirnov test. If the data followed a normal distribution, Student *t*-test was used for analysis; if not, the Mann-Whitney test was used. The reproducibility of the 3 repeated grip strength measurements on the same day, as well as the test-retest reliability between the first and second sets of measurements taken 3 weeks apart, were assessed using both instruments. The intraclass correlation coefficient (ICC) was calculated using a single measurement, absolute agreement, and a 2-way random-effect model. ICC values ranging from 0.75 to 0.90 were interpreted as indicating good reliability, while values between 0.91 and 1.00 were regarded as indicative of excellent reliability.[15] We also calculated the standard error of measurement (SEM) and minimal detectable change (MDC) at 95% confidence interval.[16]

SEM was calculated as the SD multiplied by the square root of 1 minus the (SEM = SD × $\sqrt{[1–ICC]}$). SD $\sqrt{2}$ was calculated based on the differences between the first and second sets of measurements, and the MDC was calculated using the following formula: MDC = z × SEM × , where z = 1.96 (based on 95% confidence).[16]

The MDC is a statistical measure used to determine the amount of change in grip strength that is necessary to identify a meaningful difference in the participant's performance.[17] In other words, if the difference between the 2 measurements exceeds the MDC, it can be inferred that the change in grip strength is significant. The normalized MDC is the MDC expressed as a percentage of the mean grip strength.[18] Normalization is necessary because the MDCs for the 2 instruments cannot be directly compared due to the distinct units of measurement they employ (kg and kPa).[18] For instance, an MDC of 5% implies that there should be a difference of at least 5% between the results of the first and follow-up grip strength tests to indicate a significant and actual change in grip strength. As Kim et al.[19] suggested that a change of 6.5 kg (19.5%) in grip strength

Table 1. Physical Characteristics, Anthropometry, and Grip Strength of the Participants

Variable	Male (n = 50)	Female (n = 49)	*p*-value
Age (yr)	33.7 ± 6.8	32.8 ± 7.2	0.514
Height (cm)	175.1 ± 4.1	161.4 ± 4.7	< 0.001
Weight (kg)	75.5 ± 9.8	55.5 ± 7.1	< 0.001
Body mass index (kg/m^2)	24.8 ± 3.3	21.3 ± 2.2	< 0.001
Hand span: dominant (cm)	20.2 ± 1.7	17.9 ± 0.8	< 0.001
Hand span: non-dominant (cm)	19.8 ± 1.7	17.6 ± 0.8	< 0.001
Hand size: dominant hand (cm)	20.9 ± 1.3	18.7 ± 1.1	< 0.001
Hand size: non-dominant hand (cm)	20.7 ± 1.2	18.6 ± 1.0	< 0.001
Palm length: dominant hand (cm)	11.1 ± 0.5	10.2 ± 1.1	< 0.001
Palm length: non-dominant hand (cm)	10.9 ± 0.5	10.1 ± 1.0	< 0.001
Arm span: dominant (cm)	21.0 ± 2.1	17.1 ± 1.6	< 0.001
Arm span- non-dominant (cm)	21.3 ± 1.9	17.3 ± 1.6	< 0.001
Grip strength			
Jamar: dominant hand (kg)	45.4 ± 7.7	27.1 ± 3.8	< 0.001
Jamar: non-dominant hand (kg)	41.8 ± 8.4	24.8 ± 4.5	< 0.001
MV: dominant hand (kPa)	105.1 ± 20.9	65.4 ± 13.6	< 0.001
MV: non-dominant hand (kPa)	94.9 ± 21.2	58.3 ± 13.1	< 0.001

Values are presented as mean ± standard deviation.
MV: Martin Vigorimeter.

represented the minimal clinically important difference, the acceptable normalized MCD (%) was defined when it was less than 19.5%. Pearson's correlations were used to investigate the association between the 2 instruments, as well as the relationship between grip strength and various anthropometric factors. The correlation coefficients were evaluated based on the classification proposed by Mukaka,[20] in which the ranges $r < 0.5$, $0.5 \leq r < 0.7$, $0.7 \leq r < 0.9$, and $r \geq 0.9$ were categorized as low, moderate, high, and very high, respectively. To establish the correlation of grip strength between the 2 instruments, linear regression analysis was performed with grip strength measured using MV as a dependent variable and that measured using the Jamar as an independent variable, and the conversion equation was calculated.[8)] The level of significance was set at $p < 0.05$.

RESULTS

Participant Characteristics

A total of 50 men and 49 women completed the study. One female participant was excluded because she left the institution. There was no significant difference in the mean age between men and women. Height, weight, BMI, hand span, hand size, palm length, and arm span were significantly greater in male than in female participants. Men showed greater grip strength than women using both instruments. When measured using the Jamar, the mean grip strength in men was 40.3% and 40.7% greater than that in women in the dominant and non-dominant hands, respectively. When measured using the MV, the mean grip strength in men was 37.8% and 38.6% greater than that in women in the dominant and non-dominant hands, respectively (Table 1).

Reliability of Grip Strength Measurement and MDC of Both Instruments

The ICC of 3 trials of grip strength measurement was excellent for both instruments regardless of sex and hand dominance (Table 2). Test-retest reliability (3 weeks apart) showed good to excellent ICC for both instruments (Table 2). The normalized MDC (%) was acceptable for both instruments (Table 3).

Correlation between Anthropometric Factors and Grip

Table 2. ICC of the 3 Trials of Grip Strength Measurement and Test-Retest (3 Weeks Apart) Reliability of Both Instruments

	Triplicate trials of grip strength measurement			Test-retest (3 weeks later) reliability		
	ICC	95% CI	*p*-value	ICC	95% CI	*p*-value
Total						
Jamar: dominant hand	0.985	0.979–0.989	< 0.001	0.969	0.955–0.980	< 0.001
Jamar: non-dominant hand	0.981	0.974–0.987	< 0.001	0.967	0.951–0.978	< 0.001
MV: dominant hand	0.983	0.976–0.988	< 0.001	0.966	0.950–0.977	< 0.001
MV: non-dominant hand	0.986	0.980–0.990	< 0.001	0.970	0.955–0.980	< 0.001
Male						
Jamar: dominant hand	0.960	0.937–0.976	< 0.001	0.895	0.816–0.941	< 0.001
Jamar: non-dominant hand	0.952	0.924–0.971	< 0.001	0.895	0.816–0.941	< 0.001
MV: dominant hand	0.963	0.940–0.978	< 0.001	0.917	0.854–0.953	< 0.001
MV: non-dominant hand	0.969	0.951–0.981	< 0.001	0.937	0.890–0.965	< 0.001
Female						
Jamar: dominant hand	0.915	0.863–0.949	< 0.001	0.908	0.836–0.948	< 0.001
Jamar: non-dominant hand	0.949	0.918–0.970	< 0.001	0.915	0.850–0.952	< 0.001
MV: dominant hand	0.960	0.935–0.976	< 0.001	0.934	0.883–0.963	< 0.001
MV: non-dominant hand	0.973	0.956–0.984	< 0.001	0.928	0.872–0.959	< 0.001

ICC: intraclass correlation coefficient, CI: confidence interval, MV: Martin Vigorimeter.

Table 3. SEM and MDCs in Both Instruments

	Jamar				MV			
	Pooled SD	SEM	MDC (kg)	Normalized MDC (%)	Pooled SD	SEM	MDC (kg)	Normalized MDC (%)
Total								
Dominant hand	2.5	0.5	1.2	3.4	8.3	2.4	6.6	6.3
Non-dominant hand	2.6	0.5	1.3	3.9	7.1	1.8	5.0	5.2
Male								
Dominant hand	2.9	0.9	2.6	5.7	7.0	1.3	3.6	4.1
Non-dominant hand	3.2	1.0	2.8	6.7	6.1	1.1	2.9	3.8
Female								
Dominant hand	1.7	0.5	1.4	5.2	4.8	1.2	3.4	5.3
Non-dominant hand	1.5	0.4	1.2	4.9	4.5	1.2	3.4	5.7

SEM: standard error of measurement, MDC: minimal detectable change, MV: Martin Vigorimeter, SD: standard deviation.

Table 4. Correlation between Anthropometric Factors and Grip Strength in Both Instruments

	Dominant hand				Non-dominant hand			
	Jamar	*p*-value	MV	*p*-value	Jamar	*p*-value	MV	*p*-value
Male								
Weight	0.180	0.210	0.121	0.401	0.06	0.679	0.077	0.594
Height	0.054	0.711	0.207	0.149	0.078	0.590	0.270	0.058
BMI	0.190	0.186	0.083	0.566	0.067	0.643	0.026	0.858
Hand span	0.323*	0.022	0.217	0.130	0.272	0.056	0.174	0.228
Arm span	0.387*	0.006	0.189	0.189	0.328*	0.02	0.202	0.159
Palm length	0.242	0.091	0.181	0.207	0.145	0.317	0.134	0.355
Female								
Weight	0.254	0.078	0.118	0.421	0.227	0.116	0.074	0.612
Height	0.028	0.847	–0.071	0.628	0.049	0.74	–0.074	0.613
BMI	0.315*	0.027	0.187	0.198	0.26	0.071	0.145	0.319
Hand span	0.334*	0.019	0.248	0.086	0.375*	0.008	0.251	0.082
Arm span	0.304*	0.034	0.169	0.246	0.205	0.157	0.068	0.641
Palm length	–0.032	0.827	–0.066	0.0652	–0.13	0.372	–0.095	0.517

MV: Martin Vigorimeter, BMI: body mass index.
*Statistically significant ($p < 0.05$).

Strength of Both Instruments

Grip strength was not correlated with height, weight, or BMI in either sex, except grip strength of the dominant hand in women measured using the Jamar. Grip strength measured using the Jamar was significantly correlated with hand anthropometric factors in both sexes, but the correlation was not significant when measured using the MV (Table 4).

Table 5. Pearson's Correlation Coefficient and Conversion Equation between the Jamar and MV According to Sex

	R	*p*-value	Conversion equation
Total			
Dominant hand	0.879	< 0.001	MV = 2.122 × Jamar + 8.373
Non-dominant hand	0.856	< 0.001	MV = 2.010 × Jamar + 9.683
Male			
Dominant hand	0.751	< 0.001	MV = 2.029 × Jamar + 13.066
Non-dominant hand	0.716	< 0.001	MV = 1.810 × Jamar + 19.285
Female			
Dominant hand	0.536	< 0.001	MV = 1.891 × Jamar + 14.147
Non-dominant hand	0.552	< 0.001	MV = 1.610 × Jamar + 18.304

MV: Martin Vigorimeter.

Correlation and Conversion Equation between the 2 Instruments

There was a high correlation between the 2 instruments when both sexes were analyzed together. A high correlation was observed between the 2 instruments in men, but only a moderate correlation was observed in women (Table 5). The conversion equations are summarized in Table 5.

DISCUSSION

The main findings of this study are as follows: both instruments exhibited acceptable reproducibility and test-retest reliability, with the MV demonstrating a marginally superior ICC, which was consistent with the results of previous studies.[7-9] The grip strength measured using the MV was independent of hand anthropometry, whereas that measured using the Jamar was not. A strong correlation was observed between the Jamar and MV, indicating that they were comparable, and we proposed a conversion equation based on their strong linear relationship.

Prior studies have explored the correlation between the Jamar and MV for measuring grip strength, but few have specifically focused on the Korean population.[7-10] Desrosiers et al.[9] examined a cohort of 360 Caucasians aged 60–94 years and found a strong correlation between the 2 instruments. In a study involving 94 older Dutch patients, Sipers et al.[7] evaluated the practicality and reliability of both instruments and reported that the MV was a more reliable and practical tool. Neumann et al.[8] evaluated grip strength in 339 German patients aged 14–90 years and found high reproducibility, as well as a good correlation between the 2 instruments. Park et al.[10] reported normative data of grip strength in normal Koreans, and the average grip strength in men was 110.2 kPa in the right hand and 106.5 kPa in the left hand, while in women it was 68.8 kPa in the right hand and 64.7 kPa in the left hand. Although direct comparison with our study is limited due to their focus on a Korean cohort aged between 21 years and 31 years, the mean grip strength measured by MV is comparable to those we observed in our study (men: 105.1 kPa in the dominant hand, 94.9 kPa in the non-dominant hand; women: 65.4 kPa in the dominant hand, 583. kPa in the non-dominant hand). Their study was the only research we could find that used the MV for measuring grip strength in a Korean population but with limitations of not addressing the reliability and validity of MV by comparing it with other established dynamometers. Our study is distinctive in its focus on the relationship between the Jamar and MV in a Korean population, which has not yet been well explored. Our study addressed this research gap and contributed to a more comprehensive understanding of grip strength measurement using the MV in Korean individuals.

Our findings revealed that hand anthropometric factors were significantly correlated with grip strength measured using the Jamar, but not with that measured using the MV. It is believed that the MV, which measures force per unit area, accommodates hand anthropometry more accurately than does the Jamar, which measures pure force.[1,2,9] Furthermore, previous studies indicate that grip strength measured using the Jamar is more strongly correlated with hand anthropometry than that measured using the MV.[8,9]

Although the MV has bulbs of various sizes that can be selected based on the size of the participant's hands (Fig. 2), most previous studies have used the largest bulb of MV for adults, and we also used the largest bulb in this study for several reasons.[9] First, Neumann et al.[8] found the highest correlation (r = 0.86) between grip strength measured with the second handle of the Jamar and the largest bulb of the MV. As the second handle is generally recommended to measure grip strength in the Jamar,[3] we used the largest bulb for the measurement using the MV, considering their highest correlation.[2] Second, we observed that if a bulb was too small for the hand, it would totally collapse before the maximal grip strength was applied (Fig. 5), making it reasonable to use the largest bulb when measuring grip strength using the MV.

Given the rigid handle and fixed position of the Jamar, hand anthropometric factors naturally affect grip strength, as previously reported.[8,9,11,21] For the MV with the largest bulb,

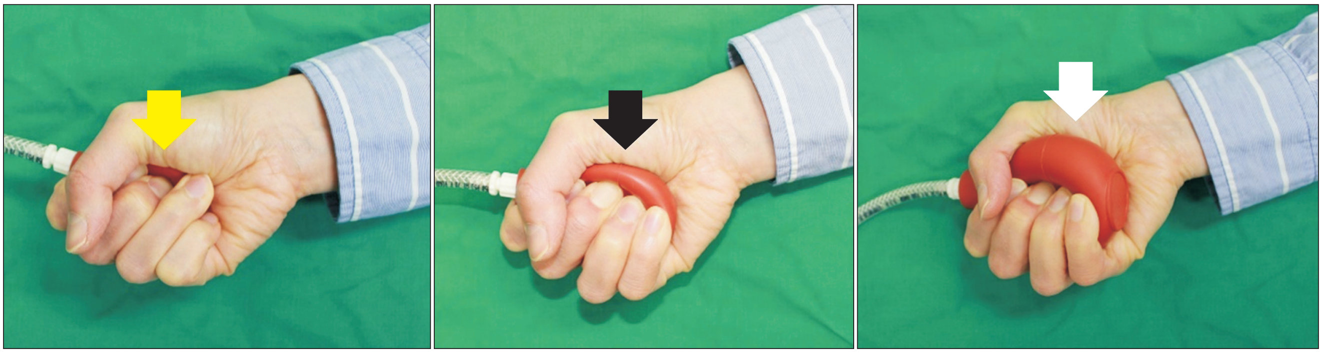

Fig. 5. Measurement of grip strength using 3 sizes of bulb in Martin Vigorimeter. If the bulb is too small for a participant's hand, it would collapse completely before applying maximal grip. The smallest (yellow arrow) and medium-sized (black arrow) bulbs collapse before the maximal grip strength is exerted, while the largest bulb (white arrow) reliably measures the maximal grip strength.

we believe that grip strength can be accurately measured because its flexibility minimizes the impact of hand anthropometry, except for a very large hand that can completely collapse the bulb before applying maximal grip force.

Previous reports showed high correlations between the 2 instruments, with correlation coefficients ranging from 0.83 to 0.90,[7-9] which is consistent with our results both when men and women were analyzed together and when men were analyzed separately (Table 5). However, only a moderate correlation was observed when women were analyzed separately (Table 5). It is noteworthy that previous studies, such as those conducted by Sipers et al.[7] and Desrosiers et al.[9] reported complaints of pain and discomfort when using the Jamar among both geriatric patients and healthy older participants. In our study, some female participants also reported difficulty in applying maximal grip strength due to the rigidity of the Jamar handle. This suggests a possibility that grip strength measured using the Jamar might be underestimated in female participants, which could explain the moderate correlation between the Jamar and MV in women. However, since this issue was not considered when designing the study protocol, further research is necessary to investigate this possible effect.

Solgaard et al.[22] proposed 4 demands for an ideal dynamometer: (1) the readings should be accurate and reproducible, regardless of the level of grip power; (2) it should not be dependent on hand anthropometry; (3) it should be comfortable for the participants; and (4) it should be small and portable. The findings of our study suggest that the MV meets all these requirements for the following reasons. First, the MV could provide reproducible and reliable grip strength measurements, comparable to those of the Jamar dynamometer. Additionally, the use of the largest bulb of the MV minimizes the impact of hand size on grip strength measurements. Furthermore, the MV is comfortable for study participants because it is made of flexible rubber and is small and lightweight, making it easy to carry around. Therefore, the MV appears to meet the requirements of an ideal dynamometer, as proposed by Solgaard et al.[22]

Our study has some limitations that should be considered. First, we did not determine the bulb size of the MV based on the hand size but rather used a single size of the largest bulb for several reasons described above. Although we did not encounter any outliers for hands that were too small to grip the largest bulb or too large to completely collapse it, if such participants had been present, it would have posed challenges. Thus, further research on the correlation between hand size and MV bulb size would be required and could be an interesting study subject. Second, although we proposed a conversion equation based on their strong linear relationship, the discrepancy in the measurement units precluded the 2 instruments from being interchangeable. Third, this study was conducted on a sample of individuals without upper-limb impairments, who were medical workers from the same hospital. This could limit the generalizability of our results to other populations with upper-limb disorders or impairments, diverse occupations, and different levels of physical activity. Finally, there was a lack of significant correlation between body anthropometric factors and grip strength in both male and female participants, although there was a weak correlation between BMI and grip strength of the dominant hand in women measured using the Jamar in this study. Despite the well-known correlation between body anthropometric factors and grip strength in large-scale studies,[1] such as that shown in a previous study based on the Korean National Health and Nutrition Examination showing a weak correlation between height, weight, as well as BMI, and hand grip strength (height: $r = 0.34$, weight: $r = 0.31$, and BMI: $r = 0.14$),[23] we might not observe this correlation due to the low correlation (as previously reported) and a limited number of participants. Future research involving a larger and more diverse sample of individuals is needed to validate the findings of this study and enhance the generalizability of our results.

In conclusion, our study provides insights into the relationship between the Jamar and MV instruments for measuring grip strength in Koreans. The MV is a viable alternative to the Jamar dynamometer in Koreans, offering not only reproducible and reliable measurements of grip strength but also the advantage of being unaffected by variations in hand anthropometry.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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