

## Validity And Reliability of Arabic Version of Jebsen Taylor Hand Function Test Post Flexor Tendon Repair

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### ABSTRACT

**Background:** The Jebsen Taylor Hand Function Test (JTHFT) is a non-diagnostic assessment scale for measuring hand and upper limb dexterity. It is commonly used worldwide to evaluate conditions such as muscular dystrophy, stroke, spinal cord injury, Parkinson's disease, carpal tunnel syndrome, and rheumatoid arthritis. The purpose of this study is to assess the validity and reliability of the Arabic version of the Jebsen Taylor Hand Function test in Egyptian patients who have undergone flexor tendon repair.

**Purpose of Study:** This study aimed to determine the reliability and validity of the Arabic translation of the Jebsen Tyler Hand Function Test in Egyptian patients who have undergone flexor tendon restoration repair.

**Subjects and Methods:** The study included hundred patients (males and females) with flexor tendon repair surgeries. They were recruited from Cairo University Educational Hospitals and Outpatient Clinics of the Faculty of Physical Therapy, Cairo University.

**Results:** The test was given to 100 patients with post-flexor tendon repair. Cronbach's alpha reported a value of 0.945 and 0.924 for both non-dominant and dominant hands respectively. A subgroup of 100 people analyzed in order to determine whether the intra- and inter-raters' reliability. The intraclass correlation coefficients' range was from 0.968 to 0.978 in the dominant and non-dominant hands.

**Conclusion:** The present study supports the usage of the JTHFT's Arabic version as a gauge of hand functionality in post-flexor tendon repair patients. It is a crucial tool for Arabic professionals and can be helpful for research into hand rehabilitation as well as clinical practice to assess improvement following rehabilitation therapies.

**Keywords:** Jebsen Taylor Hand Function Test, Flexor tendon repair surgeries, Validity, Reliability.

### INTRODUCTION

The hand serves as a superb example of sophisticated motor control and is responsible for 90% of upper limb functionality. Through the coordinated action of all digits, this sophisticated To handle objects of diverse sizes and shapes, structure is utilized as well as to carry out dexterous, individualized finger operations like drawing and painting <sup>(1)</sup>.

Hand injuries that result from accidents, illnesses, or industrial hazards can make it difficult to perform daily tasks and potentially disrupt a social obligations of a sufferer. Utilizing performance-based patient-reported outcome measures (PROMs) and outcome measures (PROMs), the functional level of the hand is assessed following hand injuries (PBOMs) <sup>(2)</sup>.

The bones in the fingers and forearm are connected by flexor tendons, which are strong, silky cords muscles, that are located between the hand and the elbow. We can flex our fingers thanks to these tendons. Surgery is typically required if flexor tendons are injured, such as through a severe cut from shattered glass. In order to restore movement to the damaged fingers, surgery seeks to heal the tendons <sup>(3)</sup>. The tendons require extensive post-operative rehabilitation in order to regain movement after healing from the damage and the operation. Normally, this time lasts 12 weeks, but for those with more severe wounds or sequelae such joint abnormalities, it may last longer <sup>(4)</sup>.

Rehabilitation typically entails a number of steps. People frequently need to wear a splint or another type of device after surgery to support or immobilize the hand and wrist. Additionally, they frequently need to perform Exercises for the hands to avoid the healed tendons sticking to adjacent tissue and limiting hand movement <sup>(4)</sup>.

For the examination of hand function, there are many tests available in the clinical literature. The evaluations of daily living activities (ADLs), such as basic self-care, remain overly generic and concentrate on the general functions as opposed to a specific hand action, notwithstanding their specificity in certain patient populations. Additionally, there are no Normative information is needed to compare the restricted hand function or standards of performance. Test of Hand Function by Jebsen Taylor (JTHFT), which gives objective measures of standardized tasks in relation to norms, was chosen as the interest test for hand function <sup>(5)</sup>.

Additionally, it assesses typical characteristics of hand actions frequently utilized in ADL. Additionally, it may be administered quickly utilizing materials that are easily accessible and in a variety of local therapeutic settings <sup>(5)</sup>.

Writing, pretending to turn pages, lifting little objects, feeding, stacking, and lifting big, heavy, and light things objects are the seven subtests that make up

the JTHFT. Each subgroup to evaluate hand function, is timed and can be measured against the standards <sup>(6)</sup>.

The JTHFT is a useful tool for evaluating hand dysfunction in a range of patient populations demographics, according to the findings of various research. The initial JTHFT yielded results that were determined being equitably persistent throughout time, and test-retest reliability was established <sup>(5)</sup>.

**METHODOLOGY**

**Study design**

The objective of this study was to evaluate the Arabic version of the Jebsen Taylor Hand Function Test for validity and reliability. The study included one hundred patients (males and females) with flexor tendon repair surgeries with ages ranging between 18 to 40 years who were recruited from Cairo University Educational Hospitals and the Physical Therapy Outpatient Clinics of Cairo University.

**Participants:**

All participants gave their written agreement after being fully informed of the study's goals, protocol, potential advantages, privacy policies, and data use. One hundred adult patients of both sexes with flexor tendon repair surgeries participated in this study.

**Inclusion criteria:**

Patients with the flexor digitorum profundus and Flexor digitorum superficialis (FDP&FDS) are surgically repaired Zone 1, 2, or 3 tendons. acute cuts, closed avulsions, and mild crush wounds. Their ages ranged between 18 to 40 years. All participants were able to read and write in Arabic. All participants were able to comprehend the test's items.

**Exclusion criteria:** Patients with mental problems, patients with difficult communication, vision, and hearing disorders, patients who didn't complete the test till the end, patients with severe deformities, and patients with high levels of pain.

**Instruments:**

The non-dominant hand is used to complete the first five unimanual items of the Jebsen Taylor Hand Function Test in Arabic (NDH) and subsequently with the dominant hand. It is conducted employing vocal instructions and regulated procedures (DH).

The JTHFT functional activities include (a) composing a 24-letter sentence with a reading level appropriate for third grade; (b) turning 300-500 (7.62 cm by 12.7 cm) cards in simulated page turning; (c) removing coins, paper clips, and bottle caps from the ground and placing them in a container; (d) stacking checkers; (e) simulated feeding; and (f) moving light cans and heavier (1 pound) cans.

A stopwatch is used to time how long it takes to complete each task in order to score the subtests. Due to the participants' weakened hand function, we allowed

them enough time to finish the test. There was a 120 second time limit on each job.

**Ethical approval:**

The study received approval from The Ethical Committee of Cairo University's Physical Therapy Faculty (NO P.T.REC/012/004657). All participants gave their written agreement after being fully informed of the study's goals, protocol, potential advantages, privacy policies, and data use. Declaration of Helsinki was followed through all conduction steps.

**Statistical analysis**

SPSS for Windows, version 10.0, was used to conduct all statistical analyses 23 (SPSS, Inc., Chicago, IL). At 0.05, the alpha level was set. To summarize, frequency tables, means, and standard deviations were used and interpret the data. Typically, internal consistency is determined through correlations between several test items <sup>(7)</sup>.

To determine internal consistency or In order The intraclass correlation coefficient was employed to evaluate test-retest reliability. (ICC). When these coefficients were greater than 0.7, we deemed them to be indicative of acceptable reliability. a set of elements' average potential split-half correlation is conceptually known as. calculating the test's face validity by statistical analysis and utilizing the Clarity index.

**RESULTS**

100 patients who matched the exclusion/inclusion requirements were recruited Consisting of 61 Males and 39 Females as shown in Table (2), their mean age value was (29.36 ± 6.081) years ranging from 18 to 40 years. Also, as shown in Table (1).

**Table (1):** Patients' general characteristics Minimum, Maximum, Mean, and standard deviation.

	Mean	Standard deviation	Minimum	Maximum
Age	29.36	6.081	19.00	40.00

**Table (2):** Sex distribution in the study group

Group	Study group	
Sex	Male	Female
Frequency	61	39

**Internal consistency (correlation of items in the JTHFT):** As shown in Table (3) the internal consistency was measured by Cronbach's alpha. Results revealed that the internal consistency of the JTHFT items was very high in both The non-the dominant and The dominant hands with Cronbach's alpha = 0.945 and 0.924 respectively. Farther more in Table (3) shows Cronbach's alpha which confirms a very good internal consistency of the Arabic version of JTHFT.

**Table (3):** Internal consistency of the Total score by Cronbach's Alpha:

Item	Cronbach's Alpha if Item Deleted	
	The non-dominant	The dominant
Writing	0.953	0.932
Turning over 3-by-5-inch cards	0.925	0.902
Picking up small common objects	0.927	0.915
Simulated feeding	0.946	0.898
Stacking checkers	0.938	0.929
Picking up large light objects	0.928	0.898
Picking up large heavy objects	0.936	0.908
Cronbach's Alpha of scale is the total	0.945	0.924

**Test-retest reliability analysis:**

**Intra-rater reliability of the total score of the non-dominant hand:**

The test re-test reliability of the total Score on the non-dominant hand was established by testing 100 patients on two different occasions by the same tester (Occasion two after 1 week of occasion one). The total score of the non-dominant hand was recorded from 100 patients on two occasions by the same tester. Table (4) and Fig. (1) demonstrated the total score measured on the 1st and 2nd occasions by the same tester with mean values of total score in the 1st and 2nd occasions ( $54.2107 \pm 6.23559$ ) and ( $52.0791 \pm 5.91578$ ) respectively.

**Table (4):** Descriptive statistics of the Total score for The non-dominant hand on the first, and second occasions for the same tester

	Tester One 1st occasion		Tester One 2nd occasion	
	Mean	SD	Mean	SD
Writing	25.7084	1.13218	25.3714	0.92014
Turning over 3-by-5-inch cards	5.2629	0.83473	4.8248	0.83266
Picking up small common objects	6.4036	0.81609	5.9015	0.79806
Simulated feeding	6.7061	0.94685	6.4734	0.91499
Stacking checkers	3.4595	0.89180	3.2933	0.88122
Picking up large light objects	3.4165	0.78183	2.9697	0.79783
Picking up large heavy objects	3.2537	0.83211	3.2450	0.77087
<b>Total score</b>	<b>54.2107</b>	<b>6.23559</b>	<b>52.0791</b>	<b>5.91578</b>

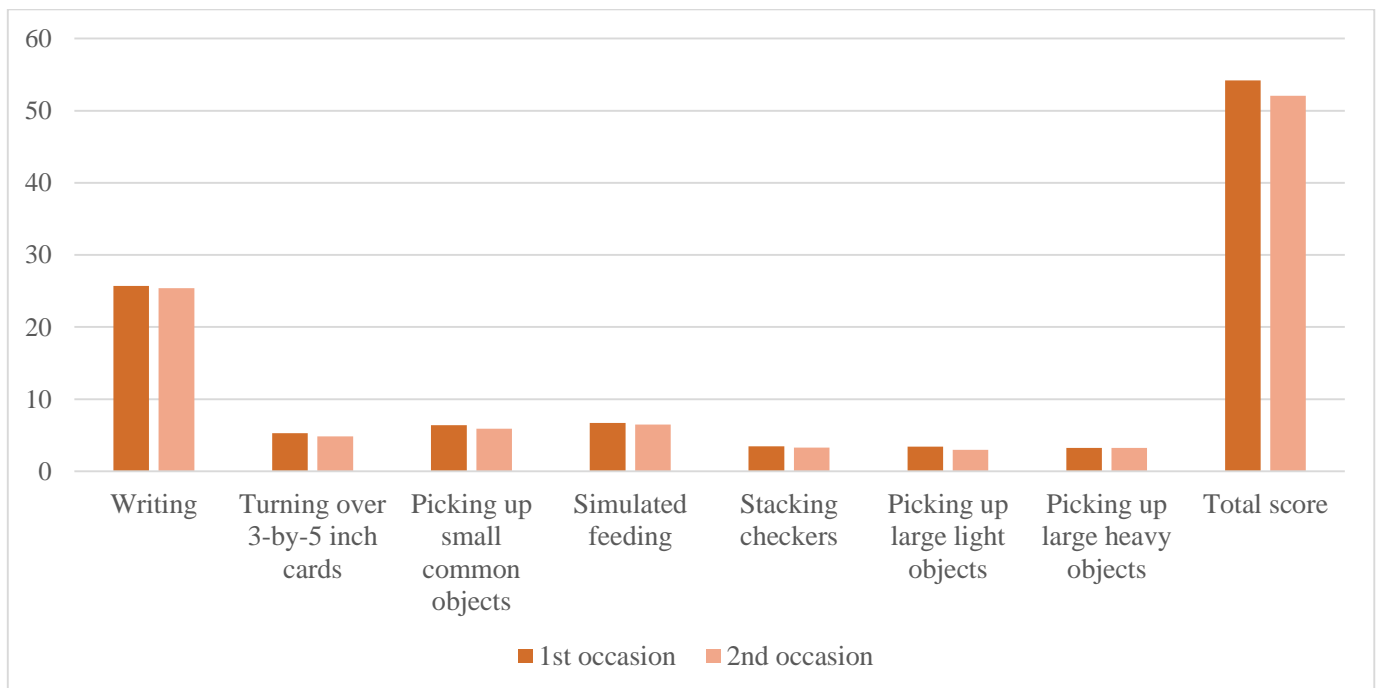


Figure (1) Mean and  $\pm$ SD of each item in the JTHFT of The non-dominant hand in seconds on the 1st and 2nd occasions by the same tester.

As shown in Table (5) and Fig. (2). The intra-rater reliability of the total score of the non-dominant hand was assessed by using the Intra-class Correlation Coefficient (ICC). The value of the ICC is ranging from 0 to 1, with values closer

to one representing the higher reliability. The ICC for Test-retest reliability of the total score was (0.978) which indicates high reliability

Table (5): ICC for Test re-test reliability of the Scale total score of the non-dominant hand between 1<sup>st</sup> and 2<sup>nd</sup> occasions for the same tester.

The non-dominant	Intra-class Correlation Coefficient
ICC	0.978
P-value	0.000
Significance	Significant

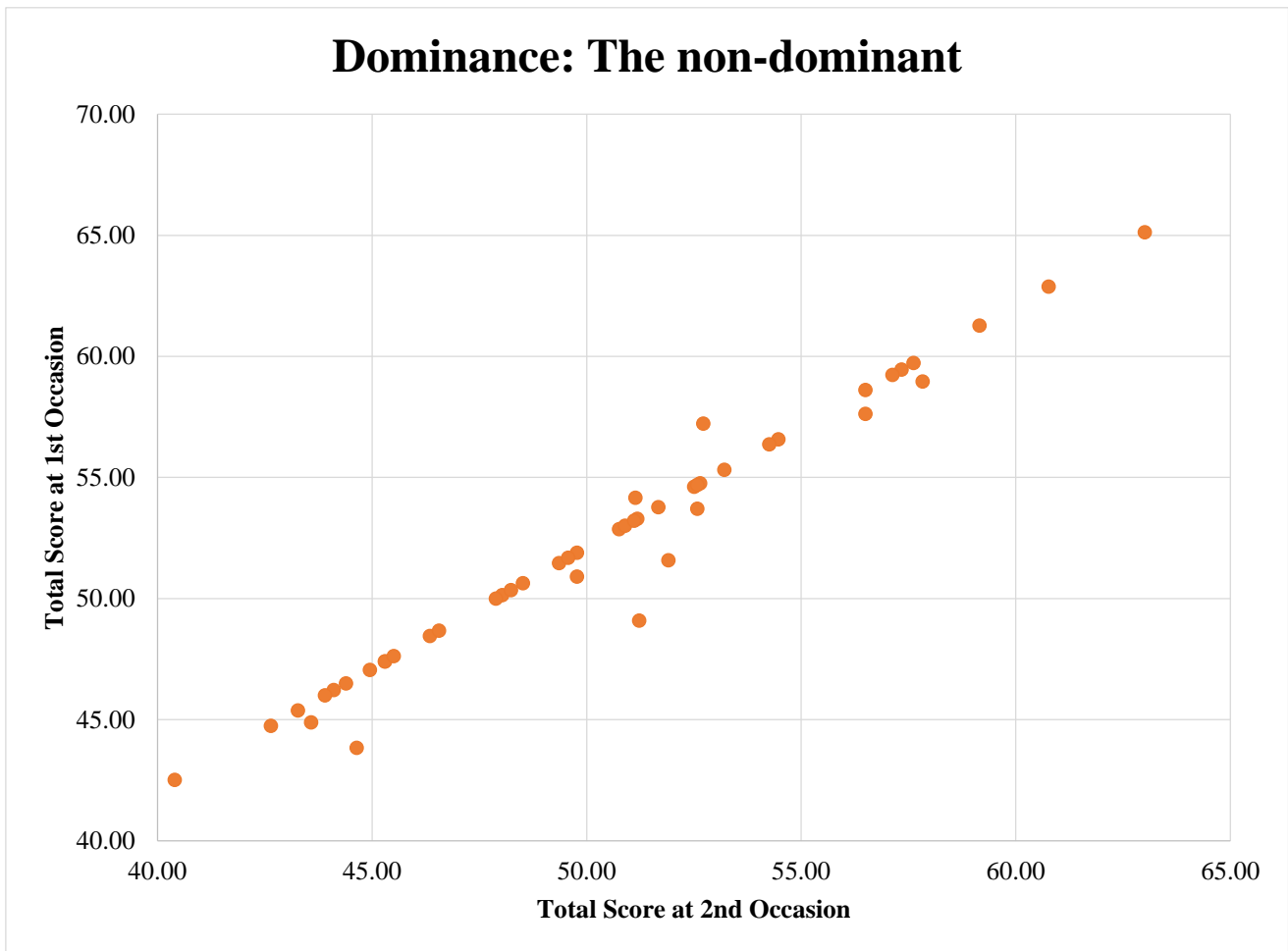


Figure (2): ICC for Test re-test reliability of the Scale total score of the non-dominant hand between 1<sup>st</sup> and 2<sup>nd</sup> occasions for the same tester.

**Intra-rater reliability of the total score of the dominant hand**

The test re-test reliability of the total score on the dominant hand was established by testing 100 patients on two different occasions by the same tester (Occasion two after 1 week of occasion one). The total score of the dominant hand was recorded from 100 patients on two occasions with the same tester. Table (6) and Fig. (3) demonstrated the total score measured on the 1st and 2nd occasions by the same tester with mean values of total score in the 1st and 2nd occasions ( $39.7646 \pm 6.01670$ ) and ( $37.0136 \pm 5.85876$ ) respectively.

**Table (6):** Descriptive statistics of the Total score for the dominant hand on the first, and second occasions for the same tester.

	Tester One 1 <sup>st</sup> occasion		Tester One 2 <sup>nd</sup> occasion	
	Mean	SD	Mean	SD
<b>Writing</b>	13.6199	1.04212	12.8721	0.77592
<b>Turning over 3-by-5-inch cards</b>	5.6109	0.90192	5.1857	0.89218
<b>Picking up small common objects</b>	6.0039	0.83264	5.5919	0.86864
<b>Simulated feeding</b>	5.7617	0.85094	5.3822	0.85034
<b>Stacking checkers</b>	3.0104	0.89689	2.7306	0.91404
<b>Picking up large light objects</b>	2.7865	0.75370	2.5638	0.78019
<b>Picking up large heavy objects</b>	2.9713	0.73850	2.6873	0.77744
<b>Total score</b>	<b>39.7646</b>	<b>6.01670</b>	<b>37.0136</b>	<b>5.85876</b>

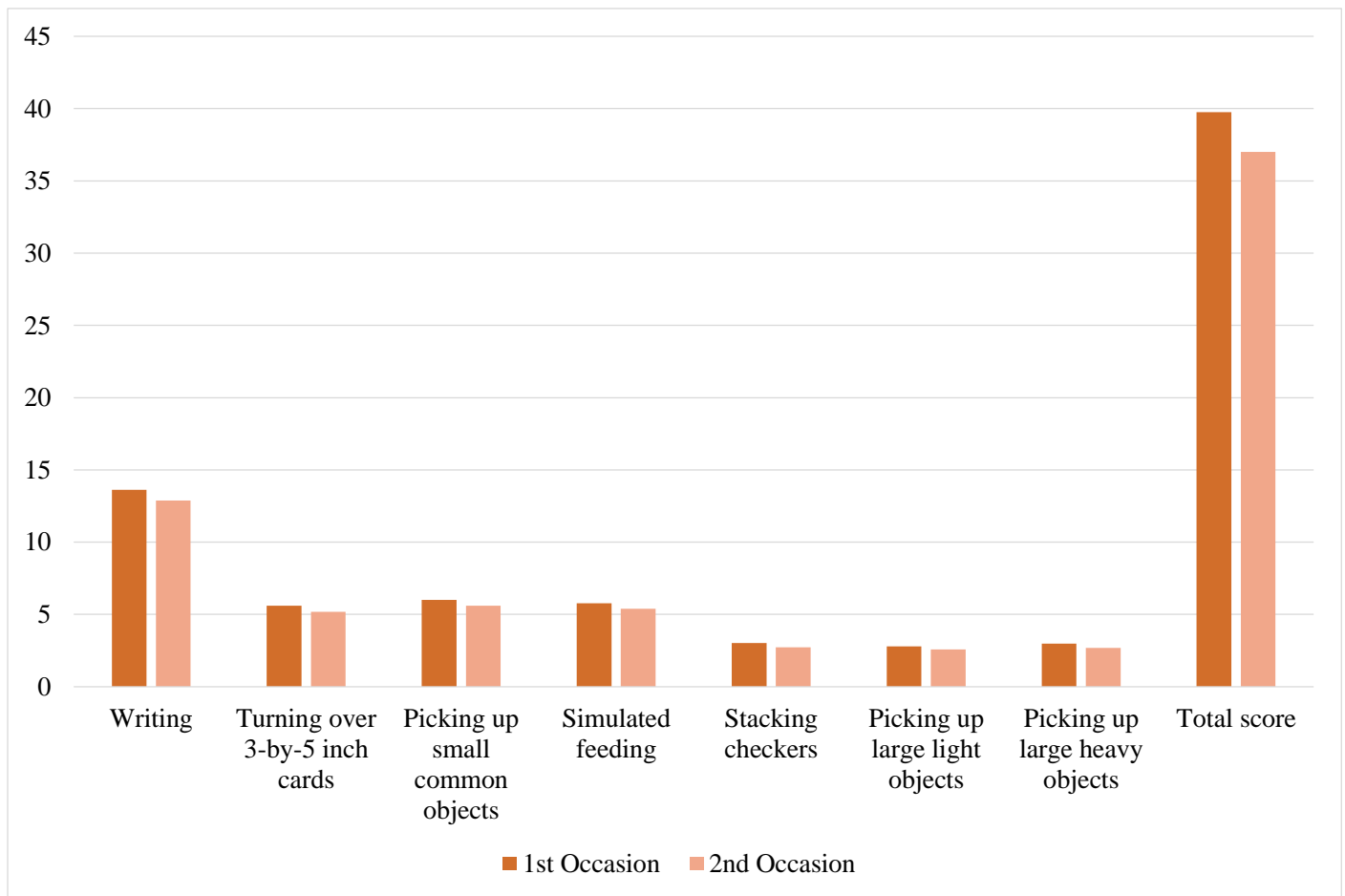
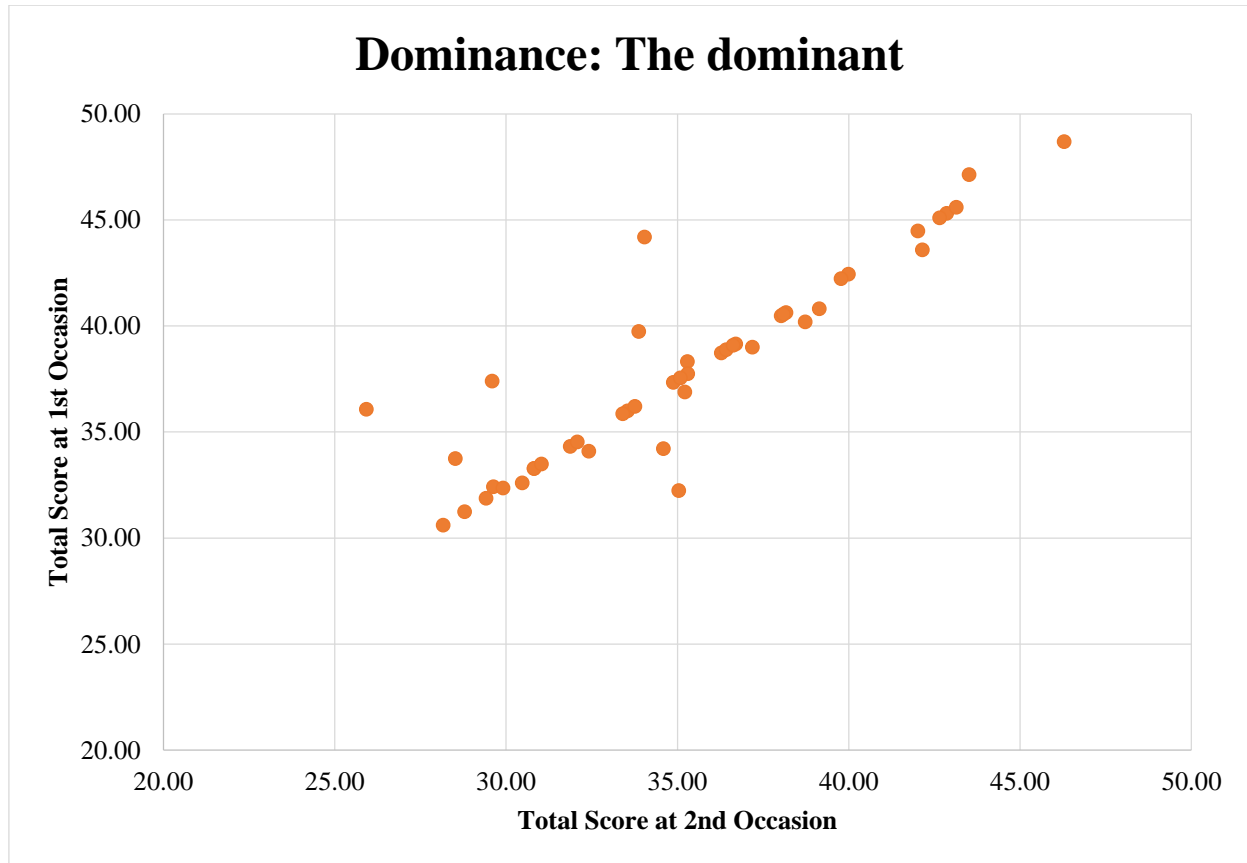


Figure (3) Mean and  $\pm$ SD of each item in the JTHFT of the dominant hand in seconds on the 1st and 2nd occasions by the same tester.

As shown in Table (7) and Fig. (4). The intra-rater reliability of the total score of the dominant hand was assessed by using the Intra-class Correlation Coefficient (ICC). The value of the ICC ranges from 0 to 1, with values closer to one representing higher reliability. The ICC for Test-retest reliability of the total score was (0.970) which indicates good reliability.

**Table (7):** ICC for Test re-test reliability of the scale total score of the dominant hand between 1<sup>st</sup> and 2<sup>nd</sup> occasions for the same tester.

The dominant	Intra-class Correlation Coefficient
ICC	0.970
P-value	0.000
Significance	Significant



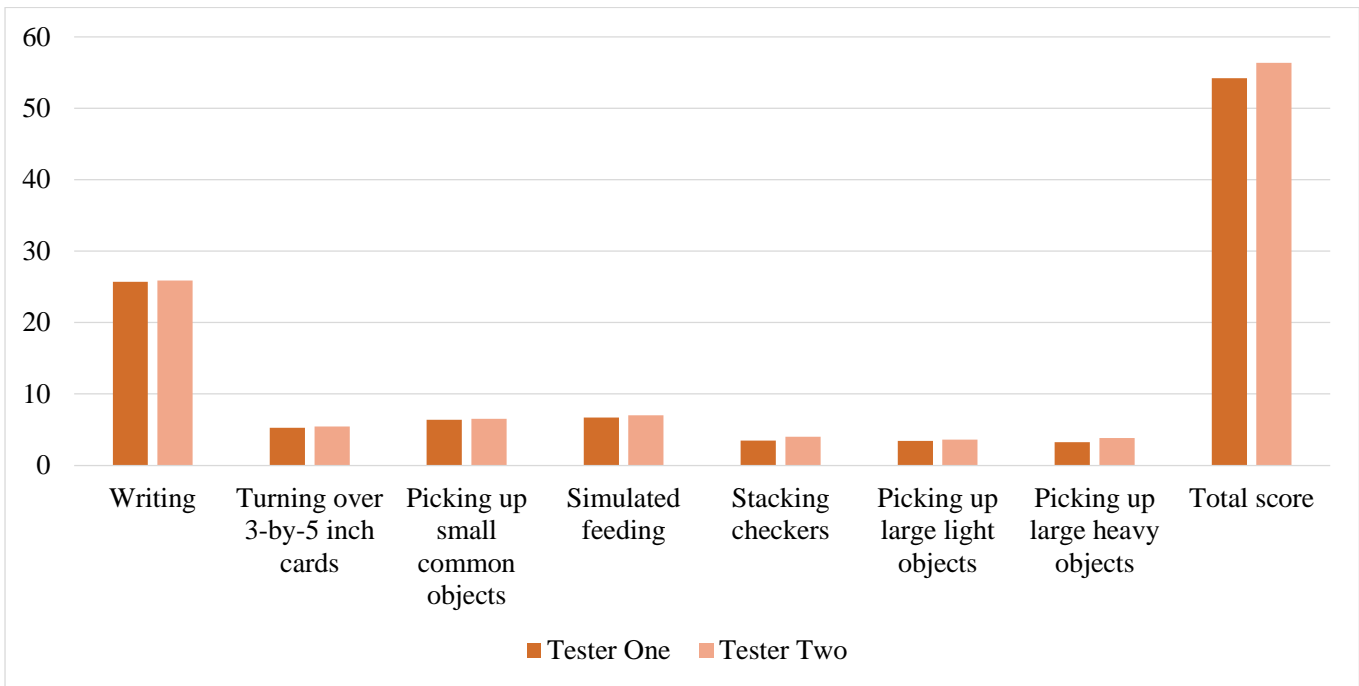
**Figure (4):** ICC for Test re-test reliability of the Scale total score of the dominant hand between 1<sup>st</sup> and 2<sup>nd</sup> occasions for the same tester.

**Inter-rater reliability of the total score of the non-dominant hand**

The inter-rater reliability of the test score of the non-dominant hand was established by testing 100 subjects by two testers (Tester 2 demonstrated the test 2 days after Tester 1 demonstration). The group means and SDs of the test totals score for the non-dominant hand, measured in seconds for the two testers are shown in Table (8) and graphically presented in Fig. (5). The mean of the total score for the non-dominant hand by tester (1) was (54.2107±6.23559) and by tester (2) was (56.3494±6.35887).

**Table (8):** Descriptive statistics of the Total score for The non-dominant hand between tester one and tested two.

	Tester One		Tester Two	
	Mean	SD	Mean	SD
Writing	25.7084	1.13218	25.9000	1.05011
Turning over 3-by-5-inch cards	5.2629	0.83473	5.4440	0.81663
Picking up small common objects	6.4036	0.81609	6.5421	0.84398
Simulated feeding	6.7061	0.94685	7.0341	0.99607
Stacking checkers	3.4595	0.89180	3.9932	1.00908
Picking up large light objects	3.4165	0.78183	3.6099	0.81692
Picking up large heavy objects	3.2537	0.83211	3.8261	0.82607
<b>Total score</b>	<b>54.2107</b>	<b>6.23559</b>	<b>56.3494</b>	<b>6.35887</b>

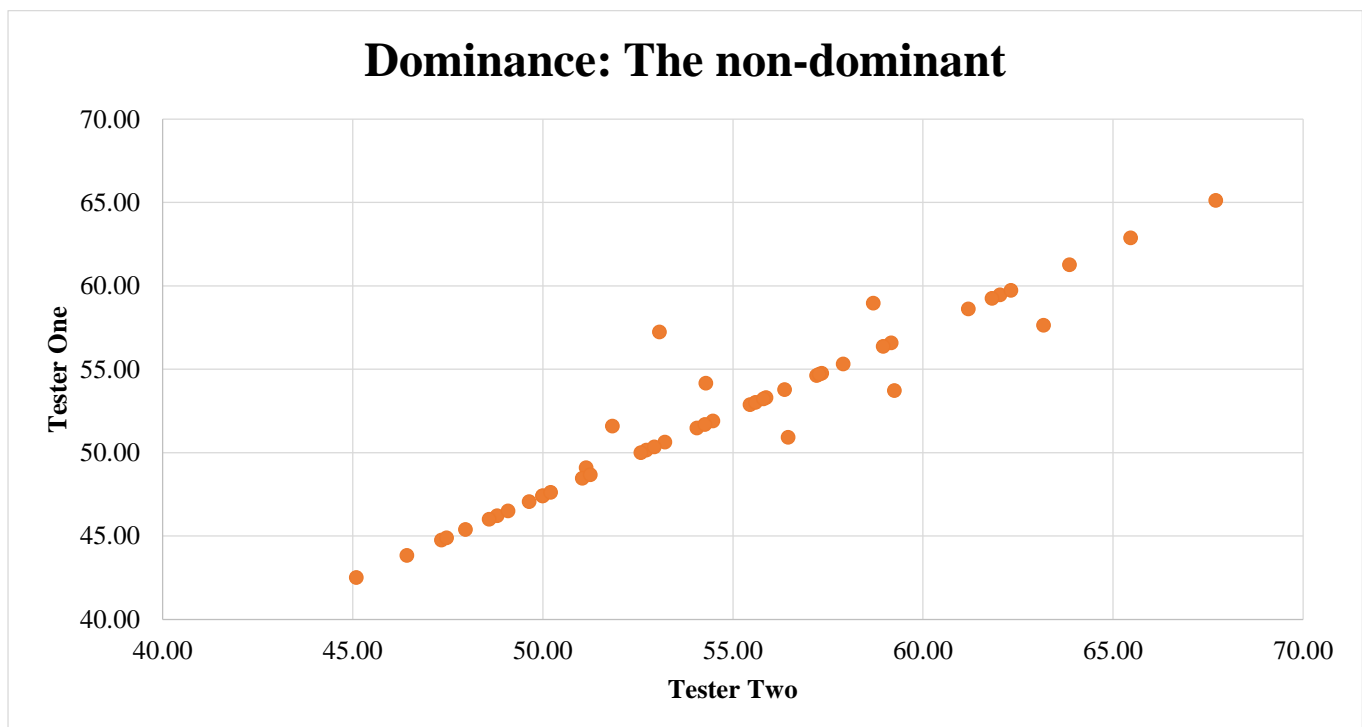


**Figure (5)** Mean and  $\pm$ SD of each item in the test of the non-dominant hand between tester one and tested two.

The inter-rater reliability of the Total score (2 testers) was assessed by using the Intra-class Correlation Coefficient (ICC). The value of the ICC ranges from 0 to 1, with values closer to one representing higher reliability. The ICC for inter-rater reliability of the total score for the non-dominant hand was (0.972) which indicates high inter-rater reliability as shown in Table (9) and figure (6).

**Table (9):** ICC for Test re-test reliability of the Scale total score of the non-dominant hand between tester one and tester two.

The non-dominant	Intra-class Correlation Coefficient
ICC	0.972
P-value	0.000
Significance	Significant



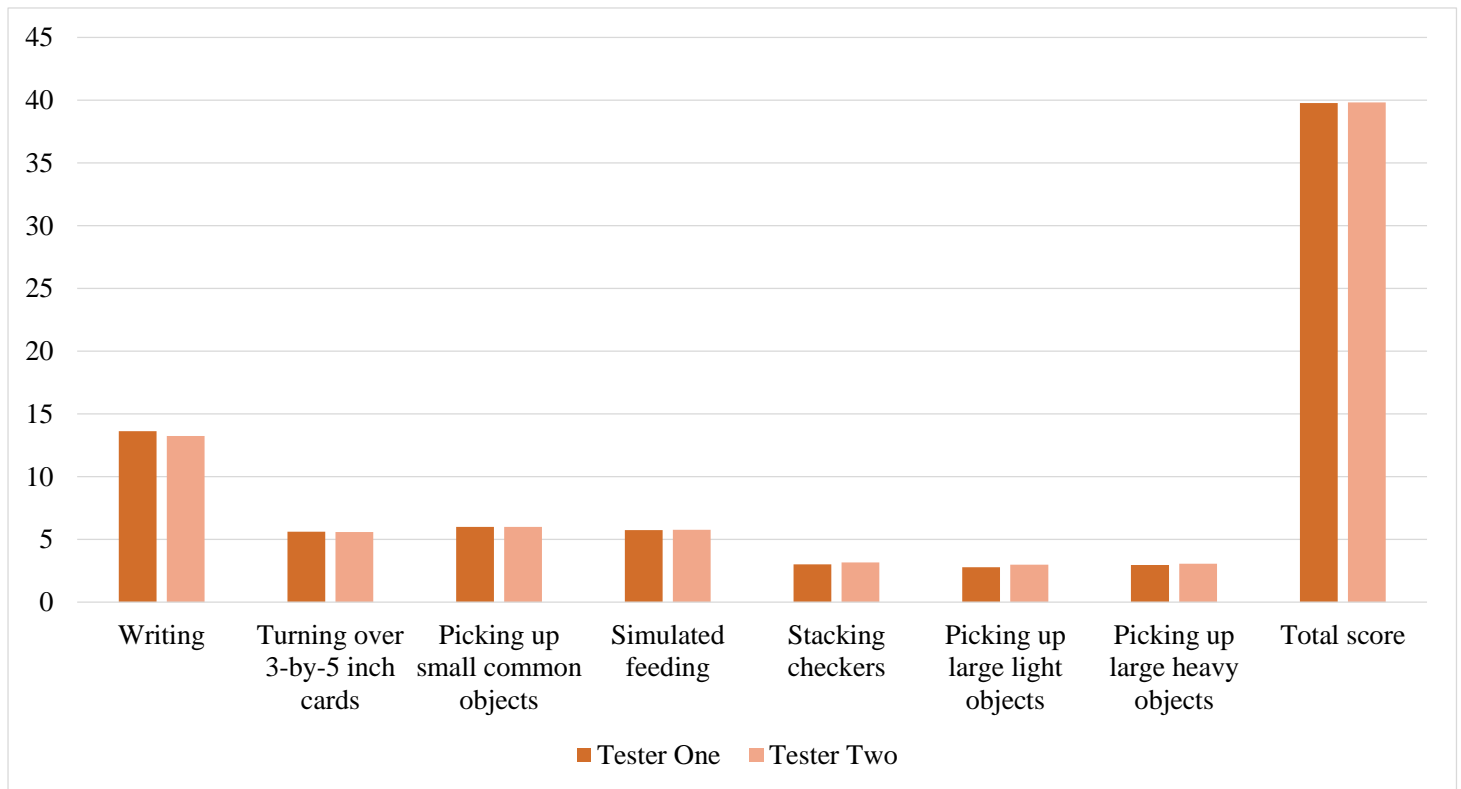
**Figure (6):** ICC for Test re-test reliability of the Scale total score of the non-dominant hand between tester one and tester two.

**Inter-rater reliability of the total score of the dominant hand:**

The inter-rater reliability of the test score of the dominant hand was established by testing 100 subjects by two testers (Tester 2 demonstrated the test 2 days after Tester 1 demonstration). The group means and SDs of the test totals score for the dominant hand measured in seconds for the two testers were shown in Table (10) and graphically presented in figure (7). The mean of the total score for the dominant hand by tester (1) was (39.7646±6.01670) and by tester (2) was (39.8215±5.9959).

**Table (10):** Descriptive statistics of the Total score for the dominant hand between tester one and tester two.

	Tester One		Tester Two	
	Mean	SD	Mean	SD
Writing	13.6199	1.04212	13.2378	0.91445
Turning over 3-by-5-inch cards	5.6109	0.90192	5.5952	0.87881
Picking up small common objects	6.0039	0.83264	6.0013	0.85945
Simulated feeding	5.7617	0.85094	5.7690	0.83542
Stacking checkers	3.0104	0.89689	3.1691	0.93400
Picking up large light objects	2.7865	0.75370	2.9873	0.78251
Picking up large heavy objects	2.9713	0.73850	3.0618	0.79129
<b>Total score</b>	<b>39.7646</b>	<b>6.01670</b>	<b>39.8215</b>	<b>5.9959</b>



**Figure (7)** Mean and ±SD of each item in the test of the dominant hand between tester one and tested two.

The inter-rater reliability of the Total score (2 testers) was assessed by using the Intra-class Correlation Coefficient (ICC). The value of the ICC ranges from 0 to 1, with values closer to one representing higher reliability. The ICC for inter-rater reliability of the total score for the dominant hand was (0.968) which indicates high inter-rater reliability as shown in Table (11).

**Table (11):** ICC for Test re-test reliability of the Scale total score of the dominant hand between tester one and tester two.

The dominant	Intra-class Correlation Coefficient
ICC	0.968
P-value	0.000
Significance	Significant



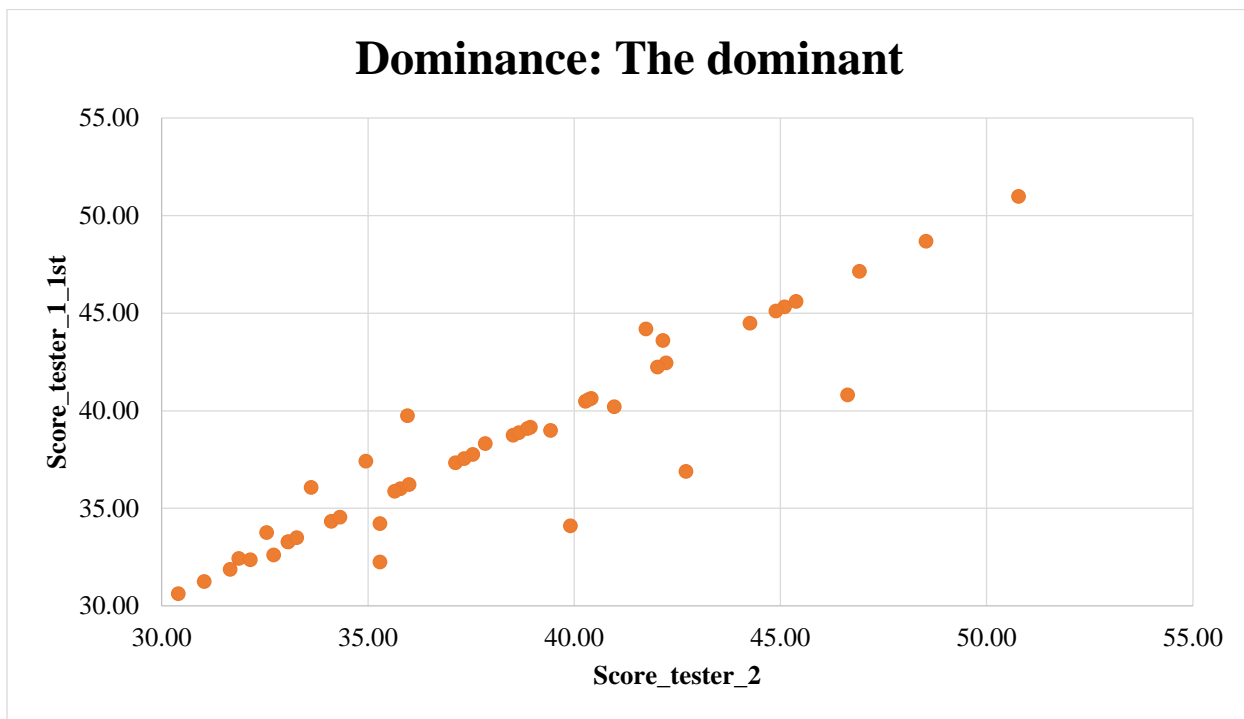


Figure (8): ICC for Test re-test reliability of the Scale total score of the dominant hand between tester one and tester two.

## DISCUSSION

The study's goal was to evaluate the reliability and validity of the Arabic translation of JTHFT in patients who had undergone flexor tendon restoration repair. The findings of our research demonstrate that Egyptians can use the JTHFT in Arabic as a legitimate and reliable tool with flexor tendon repair surgeries.

The Cronbach's alpha coefficient was used to assess the scale's consistency, providing a value of 0.945 and 0.924 for the respective non-dominant and dominant hands. A subgroup of 100 people analyzed in order to determine whether the intra- and inter-raters' reliability. intraclass correlation exists in both the dominant and non-dominant hands values ranged from 0.968 to 0.978.

This study's findings are consistent with those of earlier research; for instance, **Shaaban et al.** <sup>(8)</sup> found that Excellent face validity exists for the Arabic version of the Jebsen Taylor hand function test, as indicated by the scale index of clarity, which was equal to 100%, and the median of the clearance rate (clear responses) was equal to 100%. Additionally, it has great content validity, as indicated by the S-CVI of 92.38% and the median of the percentage of very pertinent responses, which was equivalent to 92.38%.

Additionally, it was mentioned that Strong test-retest reliability and good internal consistency were found in the Arabic version of the Jebsen Taylor hand function test, with a Cronbach's alpha of 0.79 of equal 0.598 (ranging from 0.487 to 0.660). However, statistically significant Between test and retest results, Spearman's rank correlation coefficients were discovered (item 1: 0.19, item 2: 0.52, item 3: 0.54, item

4: 0.33, item 5: 0.47, item 6: 0.789, item 7: 0.50). A Spearman's rank correlation coefficient between 0.6 and 0.7 is assessed to have adequate test-retest reliability, and one between 0.7 and 0.9 is considered to have good test-retest reliability <sup>(8)</sup>.

And in a Study with the Italian population **Savona et al.** <sup>(9)</sup> found The internal consistency of the JTHFT-IT was calculated using Cronbach's alpha, which evaluates the interrelatedness of the items, and the results indicated values for the non-dominant hand of 0.46 and the dominant hand of 0.53. Based on the item-total, it was found that item 1 (writing) is unrelated to the other items evaluation of the weight of the components. The dominant hand's Cronbach's alpha was 0.91, and the non-dominant hand's was 0.87 after the first item was eliminated, as shown in Table 2. An analysis of the intra- and inter-rater reliability was conducted on a subsample of 30 people. The JTHFT-IT showed a high degree of reliability, which is defined as a high level of agreement between assessments that were given repeatedly by the same rater or by different raters (intra- or inter-rater).

**Savona et al.** <sup>(9)</sup> agreed admitting the limits of the JTHFT with earlier authors. Other task-performance strategies are not rated in the exam; only speed is The scores will not take into account different compensatory techniques used to place the upper limb during the JTHFT. Therefore, it is crucial to provide patients the proper instructions prior to the test and to ask them to refrain from changing their approach while taking the test Alternatively, when the JTHFT score is used as an outcome, to refrain from changing their strategy in follow-up assessments. Furthermore, the JTHFT is

frequently untestable on sufferers of mild to severe functional disability. Therefore, the test should only be applied to individuals who have mild to severe hand impairment in order to measure dexterity.

## CONCLUSION

The present study recommends using the JTHFT Arabic Version as a hand functionality test in individuals who have had flexor tendon restoration. It is a crucial tool for Arabic professionals and can be helpful for research into hand rehabilitation as well as clinical practice to assess improvement following rehabilitation therapies.

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- **Conflicts of interest:** There are no conflicts of interest, according to the authors.

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