

CONCEPTUALIZATION OF A PALM TO FINGER TRANSLATION

AND TARGETED COIN PLACEMENT TEST

Julie Jones Corbett MS OTR CHT
Cold Spring, NY

OBJECTIVE:

To develop a Targeted Coin Test that approaches the problem of assessing palm to finger translation with ulnar stabilization and wrist functional oblique motion requirements in recovery of meaningful, real-life tasks.

BACKGROUND:

Recent studies investigate the role of the wrist and hand sensori-motor system and the dart throwing motion (DTM) plane in activities of daily living (ADLs). Fine motor skills are dependent on the manipulation and voluntary placement of objects to attain meaningful ADL independence. Motor Component Analysis identifies the source of dysfunction and is fundamental to the OT/PT hand therapy diagnostic and treatment process. Methods of testing In Hand Manipulation (IHM) can be broadly classified into 3 categories characterized by simulating performance, voluntary coin/pellet manipulation and placement and pegboard tasks. A literature review was conducted and a panel of experts were surveyed; both suggest there is a gap in standardized assessment tools for measuring and observing recovery of palm to finger translation and target placement with proprioceptive input from the wrist in the hand injured population.

CONTACT INFORMATION:

julie@targetedcointest.com
845-216-2360

CONFLICT OF INTEREST:

The author is currently investigating development of this product for use in a sequential clinical trail to test hypothesis.

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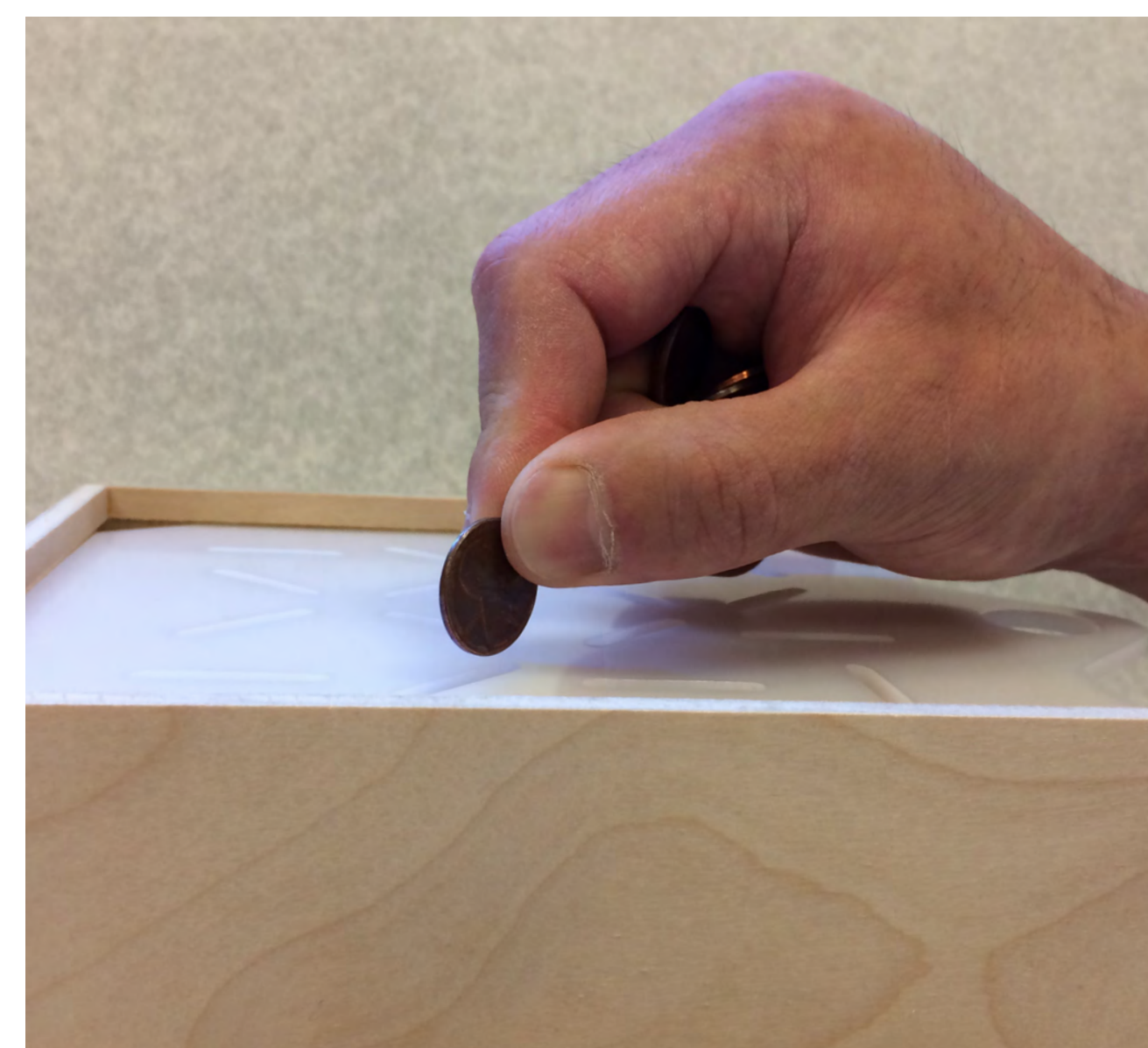
METHODOLOGY:

This specific fine motor skill can be evaluated by speed and quality of execution in test-retest format. A unique instrument was developed by the author and used in the clinic setting for 3+ years.

- It is a 6"x 6" x 2" box with 16 1" coin slots in 4 rows.
- The directionality of the coin slots is configured to require wrist functional oblique motion.
- The test requires a minimum of time (3-8 minutes) for administration including a prerequisite demonstration of finger to palm translation of 20 pennies, reading of directions, initially 2 trials per hand, recording of scores and observations.
- All participants are given verbal instruction to target at least 16 out of the 20 coins, held in their hand, into the slots.
- The opportunity for a practice trial eliminates the possible variable of unfamiliarity influencing task performance.
- Follow up tests require only one trial per hand.



Radial Deviation



Ulnar Deviation

SCORING:

One trial per hand provides 2 scores per hand and are obtained in a scoring format similar to standardized scoring in the Functional Dexterity Test and Variable Dexterity Test:

SPEED/Quantitative:

'net time' score, in seconds, to complete the test

$$\left[\left(\frac{\text{injured hand net time}}{\text{net time}} \right) - \left(\frac{\text{injured hand retest net time}}{\text{net time}} \right) \right] \div \text{injured hand net time} = \% \text{ of change in net speed}$$

ACCURACY/ Qualitative:

'net time' + (5 sec x # of dropped coins) = score

$$\left[\left(\frac{\text{injured hand net time} + \text{penalty}}{\text{net time} + \text{penalty}} \right) - \left(\frac{\text{injured hand retest net time} + \text{penalty}}{\text{net time} + \text{penalty}} \right) \right] \div \text{injured hand net time} + \text{penalty} = \% \text{ of change in accuracy}$$

Trial	Dominate	Hand Injury	DX	Net Time (sec) Right / Left	Right Hand Dropped Coins / Score	Left Hand Dropped Coins / Score	Retest Net Time (sec) Right / Left	Retest R Hand Dropped / Score	Retest L Hand Dropped / Score	Percentage of Change in Net Time (sec)	Percentage of Change in Penalty Score
1	R	R	ARTHRO	55 / 30	4 / 75	2 / 40	41 / 27	4 / 61	4 / 47	25.45%	18.66%
2	R	R	DR fx-ORIF	45 / 39	2 / 55	2 / 49	36 / 34	2 / 46	0 / 34	20.00%	-2.36%
3	R	R	DR fx-ORIF	60 / 48	0 / 60	0 / 48	37 / 35	0 / 37	3 / 50	38.33%	38.33%
4	L	R	R III Tenolysis	62 / 36	6 / 92	6 / 66	46 / 32	4 / 66	3 / 47	25.81%	28.26%
5	R	R	L CVA	39 / 36	4 / 59	0 / 36	37 / 44	4 / 57	0 / 44	5.13%	3.39%
6	R	R	RSI	25 / 27	0 / 25	0 / 27	22 / 23	2 / 32	0 / 23	14.81%	-28.00%
7	R	L	DR fx-recon	29 / 35	0 / 29	2 / 45	23 / 34	0 / 23	0 / 34	2.86%	24.00%
8	R	L	CuTS Transp	33 / 43	2 / 43	2 / 53	28 / 33	0 / 28	0 / 33	23.26%	38.00%
9	R	L	DR fx-ORIF	36 / 52	2 / 46	4 / 72	25 / 37	1 / 30	5 / 62	28.85%	14.00%
10	R	L	CTR	38 / 41	2 / 48	2 / 51	30 / 37	5 / 55	3 / 52	9.76%	-2.00%
11	R	L	DR fx-ORIF	43 / 55	0 / 43	0 / 55	33 / 35	0 / 33	0 / 35	36.36%	36.00%
12	R	L	V DuPuy rel	26 / 27	2 / 36	2 / 37	24 / 29	2 / 34	2 / 39	-7.41%	-5.00%
13	R	L	AINS	22 / 47	0 / 22	3 / 62	21 / 59	5 / 46	4 / 79	-25.53%	-27.00%
Overall Average										15.21%	12.00%

RESULTS:

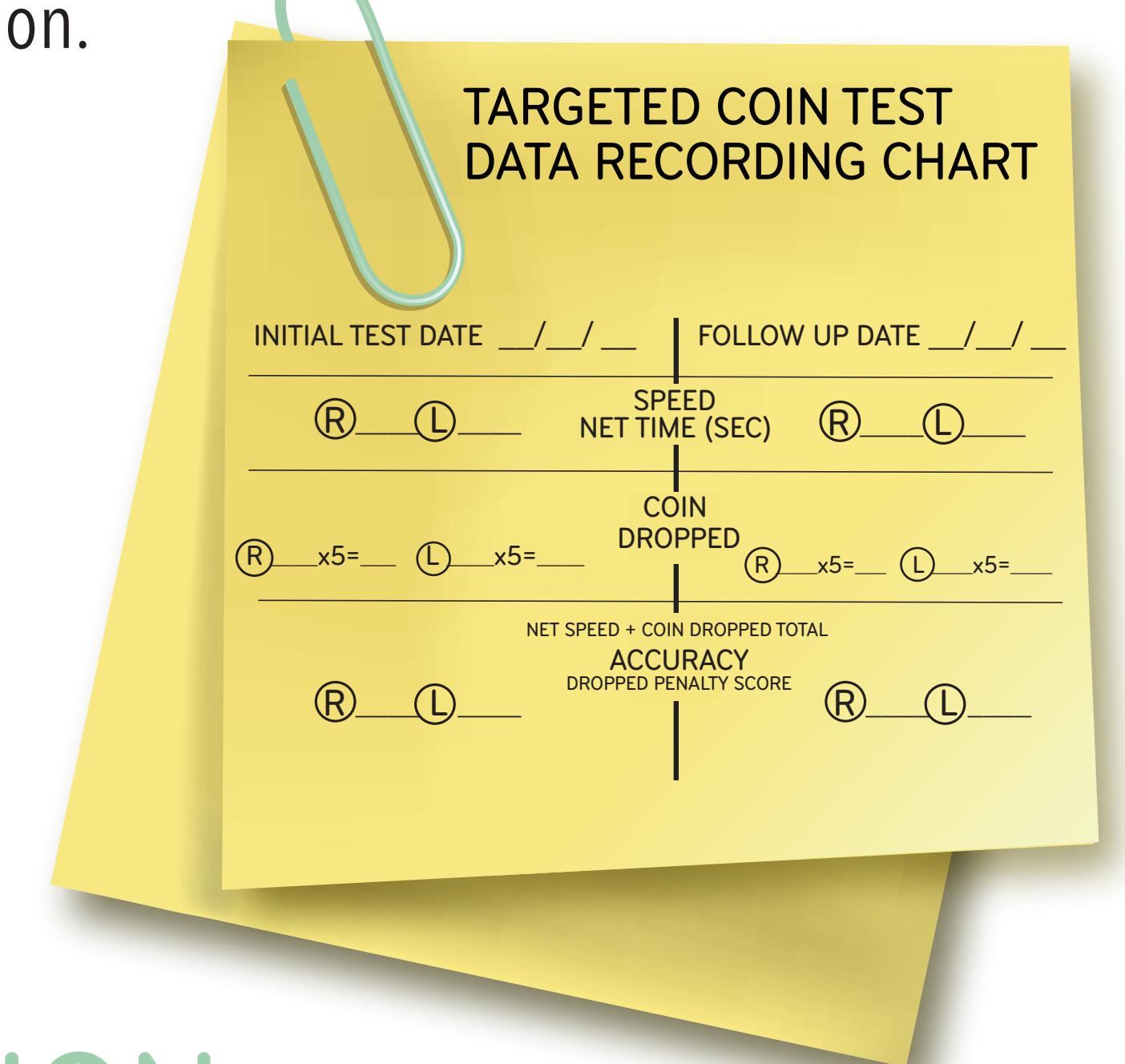
The author performed a pilot feasibility study with a convenience sample of 14 non-injured participants and 13 diverse hand injured participants. Descriptive statistics are used to analyze test scores.

Normative estimates were obtained from 14 right hand dominant, healthy participants in the 20-30 year old range.

- A 1-second difference was observed in the speed of the task between dominant and non dominant hands.
- Non injured participants dropped an average of 1.5 coins with dominant hand and 1.7 coins with non dominant hand.

In the hand injured population net time and time with penalty, retest scores and percentages of score change indicate incremental progress towards unaffected hand baseline score with test-retest comparison.

- Retest scores of the hand injured population exhibit an average 15% of change indicating decreased time, or increased speed, of execution.
- An average of 12% improvement of palm to finger translation and accurate target of coins is found in the diverse hand injured population.



DISCUSSION:

The results of a pilot feasibility study using the innovative Targeted Coin Test appears to be sensitive to change in participants' ability to perform palm to finger translation with ulnar stabilization and wrist functional oblique motion with greater efficiency and effectiveness. Availability of the test box would enhance greater data collection, consistency of tool psychometrics and refinement. Until these phases of instrument development are complete, the results obtained in this present study show encouraging values. Limitations include sample selection and size. Further qualitative and quantitative investigation may address the impact of IHM therapeutic intervention on fine motor basic self-care outcomes.