



RESEARCH ARTICLE

Development of Testing Eligibility for Evaluation and Therapy of the Hand (TEETH)

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Abstract

Development of a screening tool that focuses on the detection of problems of hand and upper extremity was investigated in this study. The purpose of this tool is to have early referral for hand therapy evaluation and subsequent therapy. The aim of the study is to check validity and reliability of Testing Eligibility for Evaluation and Therapy of the Hand (TEETH). The study design is prospective cross-sectional study. The draft TEETH was derived from relevant literatures and existing tests used for evaluation in hand manipulation and hand skill. The questions were constructed based on the theoretical background of hand therapy and clinical experience. The initial draft of TEETH consisted of 25 questions covering Pain, Range of motion, Strength/Power, In hand manipulation, Grasp and Prehension, Bilateral and unilateral hand use. Findings of the study showed that the content validity of the questionnaire is 0.75. Cronbach's alpha is 0.991, which indicates a high correlation between the items and the questionnaire is consistently reliable. The study indicated that TEETH is a valid and reliable screening tool which can be used for detecting eligible candidates for hand therapy services in a wider population.

Keywords: TEETH, screening tool, cross-sectional study, reliability, content validity, Cronbach's alpha.

Introduction

Hand and upper extremity problems are common among all the age groups of individuals. In India, there is unawareness about the scope of hand therapy. Occupational therapy and physical therapy professions themselves do not have representation at the Governmental level. It is not uncommon to have late referral of the clients for hand therapy. Sometimes there are other reasons for not referring the patients to the hand therapy services. Even though, historically hand therapy has roots in India, concept of hand therapy as a specialty is relatively new for Indian healthcare system. In this context, there is a need for different strategy, which might help clients for getting services and also for professional development. In context of occupational therapy services in Canada, Donnelly (2013) emphasized the importance of research and documentation along explicit strategies and structures required to facilitate the integration of a new professional group. Chanou and Sellars (2010) found that Physiotherapists were frustrated by the physiotherapy referral system in Greece. The study revealed that their practice was restricted by factors, which included a long-standing dominance by the medical profession, bureaucratic process and the public perception of the profession in addition to restrictions from within the profession itself. He indicated the need of professional autonomy for professional development. The research also indicates that there is a need of creating awareness among the public and hand therapist should reach to the public directly.

This will definitely widen the scope of hand therapy in India but also create the awareness about the hand therapy in general public (LaStayo and Nandgaonkar, 2013). To detect the problems in the first instance is a big task and there is need of a tool which will detect these problems. In such instances, screening tool can do the needful. The screening instruments have many advantages such as it is inexpensive; can be used for larger populations. Considering all these issues, there is an urgent need to develop a screening instrument for detecting the person who will need detailed evaluation and subsequent therapy. The present study is to develop and validate a screening tool that focuses on the detection of problems of the hand and upper extremity with the following objectives.

1. To develop a new screening tool for the hand therapy eligibility.
2. To check validity of the Testing Eligibility for Evaluation and Therapy of the Hand (TEETH) i.e. content validity and face validity.
3. To check the 'Reliability' of the test.

Materials and methods

Study design: A prospective cross-sectional study was used. The draft Testing Eligibility for Evaluation and Therapy of the Hand (TEETH) was derived from relevant literatures and existing tests used for evaluation in hand manipulation and hand skill (Exner, 1992; DeMatteo *et al.*, 1993; Henderson, 2006).

The questions were constructed based on the theoretical background of hand therapy and clinical experience. The common reasons for referral were the main criterion for selecting the construct. The initial draft of TEETH consisted of 25 questions covering the following areas. All were being close-ended questions.

- Pain
- Range of motion
- Strength/power
- In hand manipulation
- Grasp and Prehension
- Bilateral and unilateral hand use

Institutional Ethics Committee approval was taken for the study. After this, content and face validity of TEETH was checked. For checking face and content of TEETH, participants were Occupational Therapist, Physical Therapist who was dealing with cases requiring hand rehabilitation. For checking face and content validity, we recruited professionals from various institutions in Mumbai. They were asked to evaluate the questionnaire on following criterion.

1. *Clarity* in question so that individual gives an appropriate response.
2. *Simple* means ease of use of question during the administration of questionnaires.
3. *Neutral/Fairness* (Impartial) of questions to get an unbiased response from an individual.
4. *Relevance* of question to the meet purpose of the questionnaire.

They were requested to rate these questions according to 5 point Likert scale (1-5 scale). 1 indicates that you "Strongly Disagree", 2 indicates that you "Disagree", 3 indicates that you "Agree To Some Extent", 4 indicates that you "Agree" and 5 indicate that you "Strongly Agree". The questions were finalized which fit to the above mentioned criterion. The relevance of the question was the most important criterion. The relevance mainly decided the inclusion of the question in the final version (Content validity) (DeVon *et al.*, 2007). To check the face validity of the questionnaire, we recruited 20 professionals. The professionals were Occupational Therapist and Physical Therapists. The next step in examining the validity was to check the discriminant validity of the newly developed TEETH. Discriminant validity examines the extent to which a measure correlates with measures of attributes that are different from the attribute the measure is intended to assess (Suri, 2010). After the formation of the final version, we administered the questionnaire on normal adults without hand trauma, average intelligence and clients receiving hand trauma. For checking discriminate validity, we enrolled adults without hand trauma, having average intelligence and adults with hand trauma, average intelligence between the age of 20 years and 50 years (Known groups' method). We recruited patients attending the Occupational Therapy Services for hand and upper extremity trauma.

A total of 20 patients entered into this phase. The participants graded their difficulty in each of the tasks as: No, Mild, Moderate, Severe or Complete difficulty. This was done after taking informed written consent. All the cases related to shoulder were included in the study. For any screening tool, the reliability of the instrument is one of the important features. Internal consistency-examines the inter-item correlations within an instrument and indicates how well the items fit together conceptually (Nunnally and Bernstein, 1994; DeVon *et al.*, 2007). In addition, a total score of all the items is computed to estimate the consistency of the whole questionnaire.

Internal consistency is measured in two ways: Split-Half reliability and Cronbach's alpha correlation coefficient (Trochim *et al.*, 2007). In Split-Half reliability, all items that measure the same construct are divided into two sets and the correlation between the two sets is computed. Cronbach's alpha is equivalent to the average of the all possible split-half estimates and is the most frequently used reliability statistic to establish internal consistency reliability (Trochim *et al.*, 2007; DeVon *et al.*, 2007). Both Cronbach's alpha and split half test were computed to examine the internal consistency of the TEETH.

Test retest reliability: A way of estimating the reliability of a scale in which individuals are administered the same scale on two different occasions and then the two scores are assessed for consistency. This method of evaluating reliability is appropriate only if the phenomenon that the scale measures is known to be stable over the interval between assessments.

Guidelines for interpretation: After gathering the data from the participant about the level of difficulty, it is converted into numerical scores of 0 to 4 (No difficulty = 0, Complete difficulty = 3). One should calculate the total score by following the formula:

$$\text{Total score} = A(0)+B(1)+C(2)+D(3)+E(4)$$

After this, we got the total score in the range of 0 to 100. Table 1 shows criterion for interpretation of TEETH total scores. If total score equal to zero, he may not need hand therapy evaluation. All the scores which are above zero should undergo detailed hand therapy evaluation and determine need for hand therapy. After collection of the data, the master chart was prepared and statistically analyzed with SPSS software.

Table 1. Criterion for interpretation of TEETH scores.

S. No.	Level of difficulty	If total score is
1.	No difficulty	0 (zero)
2.	Mild difficulty	>0 till 25
3.	Moderate difficulty	>25 till 50
4.	Severe difficulty	>50 till 99
5.	Complete difficulty	100

Results

The professionals used for checking validity had clinical experience ranging from 2 to 32 years. The total patient population taken for checking the discriminant validity was 20 (13 Males and 7 Females). The mean age was 37.85 ± 8.014 years (Table 2 and 3).

Table 2. Demographics of the study sample.

	No.	Mean age (years)	Standard deviation
Males	13	36.92	7.95
Females	7	39.57	8.21
Total	20	37.85	8.014

Table 3. Discriminant validity and mean score.

T-test for equality of means.						
T	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% Confidence interval of the difference	
					Lower	Upper
5.122	18.000	.000	34.21053	6.67963	20.17715	48.24390

This signifies that the tool is able to discriminate between normal and abnormal.

Content validity: Three questions were changed according to the suggestions of the participants. For the content validity, I retained items with the Content Validity Index (CVI) of 0.75 and more. Rest, I discarded.

1. Do you have problem in holding a tennis ball with either hand? This question was changed to "holding an apple". This was because experts thought that community may not understand "Tennis Ball".
2. Do you have problem with operating mobile with your hand? We deleted this question as everybody may not be using the mobile.
3. Do you have problem washing the face? This question also deleted.

Face validity: A form of content validity, face validity is assessed by having 'experts' (this could be clinicians, clients or researchers) to review the contents of the test to see if the items seem appropriate. Because this method has inherent subjectivity, it is typically used during the initial phases of test construction. Initially we had questionnaire printed in the landscape format, later changed to portrait format. Also initial draft each row of the table had entire question as "Do you have problem buttoning or unbuttoning?" But with the suggestion of the experts I included "Do you have problem....." as common part at the top of the table. The later part of the question is kept in each row. This reduced the clutter in the questionnaire. It looked neat and tidy. This improved the overall appearance. Also, 95% indicated that they understood the questions and found them easy to answer.

Discussion

Presently there is no screening tool for screening individuals eligible for the hand therapy evaluation and therapy, if needed. In this context, TEETH were formulated. Before I actually used it on large population, its development process should be stringent. In this context, the experiment was carried out.

I checked the content validity of the questionnaire (0.75) and included the validity of the instrument. The results show that newly developed tool is valid and reliable. Reliability statistics show that the instrument is reliable for test retest and internal consistency of the items (Table 4). Cronbach's alpha was computed for the revised TEETH after construct validation was computed and was 0.991, which indicates a high correlation between the items and the questionnaire is consistently reliable (Cronbach's alpha based on standardized items). I had decided that, as it is behavioral measure, I will accept if it is 0.7 or more (Table 5).

Table 4. Reliability statistics. Test retest reliability, Non-parametric correlations, Correlation is significant at the 0.01 level (2-tailed) (N=20).

Question No.	Test retest reliability	Internal consistency
	Spearman's rho	Corrected Item-Total Correlation
1.	1.00	0.550
2.	1.00	0.809
3.	1.00	0.800
4.	1.00	0.777
5.	0.994	0.932
6.	0.995	0.939
7.	0.99	0.942
8.	1.00	0.938
9.	1.00	0.944
10.	1.00	0.891
11.	1.00	0.937
12.	1.00	0.971
13.	1.00	0.971
14.	1.00	0.932
15.	0.997	0.901
16.	0.978	0.821
17.	1.00	0.915
18.	1.00	0.929
19.	1.00	0.906
20.	1.00	0.970
21.	1.00	0.959
22.	1.00	0.924
23.	1.00	0.879
24.	1.00	0.925
25.	1.00	0.916

Though according to the present analysis, predictive validity is equal to 1, sensitivity and specificity of the test should be checked on the larger population. But a word of caution, over reliance on this should be avoided. There are chances of over diagnosis, unnecessary delay for the required medical or surgical intervention. In India, while the hand therapy has been recently recognized as an important aspect of health care by certain organizations, health care providers find it difficult to refer patients at the right time and to the right professionals.

Table 5. Split-half Reliability.

Cronbach's Alpha	Part 1	Value	0.977
		N of items	13 ^a
	Part 2	Value	0.983
		N of items	12 ^b
	Total N of items		25
Correlation Between Forms			0.960
Spearman-Brown Coefficient	Equal length		0.979
	Unequal length		0.979
Guttman Split-Half Coefficient			0.978
a. The items are: Moving either of the arms in all directions? Holding an apple with right or left hand? Releasing an apple after holding? In holding a hammer in your hand? With hammering nails with your dominant hand? Holding a pen for writing in your dominant hand? Writing with the pen with your dominant hand? Lifting Rs. 1 coin from the Tabletop? Releasing Rs. 1 coin into the piggy bank? Making tower with the blocks? (4 minimum), Passing object in the one hand to another? Unscrewing the bottle top with your dominant hand? Turning one page at a time with your dominant hand?			
b. The items are: Throwing an apple at least 5 feet away with your dominant hand? Rotating the pencil to use the eraser end? Lifting large heavy box with both the hands? Holding a paper during scissors use? Using scissors to cut paper or the cloth with your dominant hand? Combing hair? Eating with the hand? Cutting with a knife? Buttoning or unbuttoning? Lifting the heavy basket with right or left hand? Finding things in a pocket, bag, using touch only (without looking)? Opening lock with the key?			

This might be largely because of subjective preference or because of the awareness. This study reported the psychometric validation of the TEETH to decide the eligibility of the candidate for detailed hand therapy evaluation according to a specific definition and contexts. This is not at all alternative to the routine referral services but will be helpful for widening the scope of the existing practice in addition to awareness creation.

Conclusion

For detecting eligible candidates for hand evaluation and hand therapy services, TEETH is a valid and reliable screening tool. The final version of TEETH may be translated for its use in the local languages viz. Marathi and Hindi. For each language the scale in two versions will be translated. The first version will be done by informed translator and another one by uninformed translator. Discrepancies in the final translated version should be resolved. After this it will create back translations and match with the original one, also doing factor analysis and checking.

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