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## 17

# Clinical Rating Scale for Tremor

*Stanley Fahn, Eduardo Tolosa, and Concepción Marín*

The word *tremor* is derived from the Latin *tremere*, meaning "to tremble." Tremor can be defined as involuntary oscillations of any part of the body around any plane, such oscillations being either regular or irregular, in rate and amplitude and resulting from alternate or synchronous action of groups of muscles and their antagonists (definition slightly modified from Holmes, 1904.)

Tremors are usually classified according to their phenomenology, most commonly "present at rest," "present with postural sustentation," "present with action," and "present with intention" (i.e., on approaching the target of a skilled movement) (Fahn, 1972; Jankovic and Fahn, 1980; Findley et al., 1984). Tremor at rest is almost always a sign of parkinsonism, whereas postural tremor is most commonly a sign of essential tremor. The latter condition will usually be even more pronounced with action and often with intention. Intention tremor is typically a feature of a lesion of the cerebellar outflow pathway, but, when severe, usually spreads to become a postural tremor. Enhanced physiological tremor resembles essential tremor, although it often has a faster frequency (Marsden et al., 1983).

Although the arms are the part of the body most commonly affected by tremor of all types, other parts of the body are not immune from developing tremor. In parkinsonism, tremor occurs most often in the distal extremities, but can also involve the lips, chin

and tongue. Essential tremor, besides appearing in the arms, can also appear in the neck and vocal cords. Cerebellar tremor often involves the head and trunk (titubation). When tremor appears only with writing, it is called primary writing tremor (Rothwell et al., 1979), which many consider to be a form of essential tremor. Tremor can involve the thighs and trunk, only with standing and not with walking, the so-called orthostatic tremor (Heilman, 1984).

Not all rhythmic movements are considered to be tremor (Fahn, 1984). Rhythmic jerking is seen in some forms of myoclonus (Fahn et al., 1986), particularly palatal and ocular myoclonus, and other forms of segmental myoclonus are often rhythmical (Jankovic and Pardo, 1986). Dystonia can appear as a rhythmic pattern; in such cases it is termed dystonic tremor (Jankovic and Fahn, 1980; Fahn et al., 1987). On the other hand essential tremor can be present in patients with dystonia (Yanagisawa et al., 1972; Couch, 1976).

Studies evaluating drug trials for controlling tremor have used a number of methods to estimate tremor severity. Accelerometer recording has been popular with some investigators (Koller, 1984; Findley et al., 1985), but this method ordinarily requires a laboratory setting and specialized instrumentation, which is not feasible for most neurologists. A similar problem exists with methods using the detection or interruption of light, such as a polarized light goniometer (Francis et al., 1986). Clinical assessment by having "blinded" observers rate global severity from randomized videotape sequences (Duquette



et al., 1985) is not unreasonable, but it does not allow for quantitation of small changes or even qualification of different aspects of tremor. Combinations of accelerometry and clinical assessment from videotape recordings are also utilized (Hallett et al., 1985).

Sweet and his colleagues (Sweet et al., 1974) developed a clinical rating scale for tremor for their study evaluating the effects of propranolol in essential tremor. It was a weighted scale assigning different point values to different affected body areas. For example, this scale gives more points for arm tremor than for tongue tremor, which in turn scored higher than jaw tremor, which scored higher than head tremor. The points for the presence of tremor in each region was then multiplied by a factor (1 to 3) reflecting severity at each site, with 1 being mild, 2 moderate, and 3 marked. To the sum of these products was added a score for functional impairment. For this functional score, a weighted number was assigned to various activities, namely, handling a cup, handling food, use of hands,

swallowing, talking, and walking. These points were multiplied by the severity factor used for severity of tremor.

The clinical rating scale developed by Sweet et al. (1974) was designed specifically for essential tremor and not for other tremors, such as resting tremor. Other disadvantages are a 4-point instead of a 5-point scale for severity; the lack of definitions for mild, moderate, and marked severity; and weighting dependent on the involved body site and the type of function that is impaired. Many important functional activities, such as writing and shaving, are not considered individually, but are lumped together as "use of hands." The impact of tremor on the patient's ability to work was not assessed. Moreover, voice tremor was not considered, except subjectively by the patient, as a symptom.

For these reasons the authors decided to develop a new clinical rating scale for tremor, one that could be used for quantitating rest, postural, and action/intention tremors (Table 17-1). This scale would also evaluate voice

Table 17-1. Definitions of Tremor Scale

**1-9. Tremor:** Rate tremor

- 1) at REST (in repose). For head and trunk, when lying down.
- 2) with posture holding (UE: arms outstretched, wrists mildly extended, fingers spread apart; LE: legs flexed at hips and knees), foot dorsiflexed; tongue: when protruded; head and trunk: when sitting or standing)
- 3) with ACTION and INTENTION (UE: finger to nose and other actions; LE: toe to finger in a flexed posture)

0 = None

1 = Slight (amplitude < 0.5 cm). May be intermittent.

2 = Moderate amplitude (0.5-1 cm). May be intermittent.

3 = Marked amplitude (1-2 cm)

4 = Severe amplitude (> 2 cm)

**10. Handwriting:** Have patient write the standard sentence: "This is a sample of my best handwriting," sign his or her name, and write the date.

0 = Normal

1 = Mildly abnormal. Slightly untidy, tremulous.

2 = Moderately abnormal. Legible, but with considerable tremor.

3 = Markedly abnormal. Illegible.

4 = Severely abnormal. Unable to keep pencil or pen on paper without holding hand down with the other hand.

**11-13. Drawings (A,B,C):** Ask the patient to join both points of the various drawings without crossing the lines. Test each hand, beginning with the lesser involved, *without leaning the hand or arm on the table.*

0 = Normal

1 = Slightly tremulous. May cross lines occasionally.

2 = Moderately tremulous or crosses lines frequently.

3 = Accomplishes the task with great difficulty. Many errors.

4 = Unable to complete drawing.



Table 17-1. *Continued.*

- 
14. **Pouring:** Use firm plastic cups (8 cm tall), filled with water to 1 cm from top. Ask patient to pour water from one cup to another. Test each hand separately.
- 0 = Normal
  - 1 = More careful than a person without tremor, but no water is spilled.
  - 2 = Spills a small amount of water (up to 10% of total amount).
  - 3 = Spills a considerable amount of water (>10–50%).
  - 4 = Unable to pour without spilling most of the water.
15. **Speaking:** This includes spastic dysphonia if present.
- 0 = Normal
  - 1 = Mild voice tremulousness when "nervous" only.
  - 2 = Mild voice tremor, constant.
  - 3 = Moderate voice tremor.
  - 4 = Severe voice tremor. Some words difficult to understand.
16. **Feeding (other than liquids):**
- 0 = Normal
  - 1 = Mildly abnormal. Can bring all solids to mouth, spilling only rarely.
  - 2 = Moderately abnormal. Frequent spills of peas and similar foods. May bring head at least halfway to meet food.
  - 3 = Markedly abnormal. Unable to cut or uses 2 hands to feed.
  - 4 = Severely abnormal. Needs help to feed.
17. **Bringing Liquids to Mouth:**
- 0 = Normal
  - 1 = Mildly abnormal. Can still use a spoon, but not if it is completely full.
  - 2 = Moderately abnormal. Unable to use a spoon. Uses cup or glass.
  - 3 = Markedly abnormal. Can drink from cup or glass, but needs 2 hands.
  - 4 = Severely abnormal. Must use a straw.
18. **Hygiene:**
- 0 = Normal
  - 1 = Mildly abnormal. Able to do everything, but is more careful than the average person.
  - 2 = Moderately abnormal. Able to do everything, but with errors; uses electric razor because of tremor.
  - 3 = Markedly abnormal. Unable to do most fine tasks, such as putting on lipstick or shaving (even with electric shaver), unless using two hands.
  - 4 = Severely abnormal. Unable to do any fine-movement tasks.
19. **Dressing:**
- 0 = Normal
  - 1 = Mildly abnormal. Able to do everything, but is more careful than the average person.
  - 2 = Moderately abnormal. Able to do everything, but with errors.
  - 3 = Markedly abnormal. Needs some assistance with buttoning or other activities, such as tying shoelaces.
  - 4 = Severely abnormal. Requires assistance even for gross motor activities.
20. **Writing:**
- 0 = Normal
  - 1 = Mildly abnormal. Legible. Continues to write letters.
  - 2 = Moderately abnormal. Legible, but no longer writes letters.
  - 3 = Markedly abnormal. Illegible.
  - 4 = Severely abnormal. Unable to sign checks or other documents requiring signature.
21. **Working:**
- 0 = Tremor does not interfere with the job.
  - 1 = Able to work, but needs to be more careful than the average person.
  - 2 = Able to do everything, but with errors. Poorer than usual performance because of tremor.
  - 3 = Unable to do regular job. May have changed to a different job because of tremor. Tremor limits housework, such as ironing.
  - 4 = Unable to do any outside job; housework very limited.
-



tremor, handwriting and other specific tasks of the hands, such as hygienic care and dressing. Functional disability and tremor impact in terms of patient ability to work is also scored. It was decided to use only a uniform, not a weighted score. The larger number of scorings for the upper extremities intrinsically increases weight, however, since the new scale measures many functions dependent on the hands, such as writing, pouring, dressing, and feeding. Definitions are provided to aid the investigator; this should also improve concordance among clinicians. The scale for severity is based on 5 points, rather than 4, providing a more finely tuned assessment.

### Description of New Clinical Rating for Tremor

The new rating scale is divided into three parts (A, B, and C), each yielding a subtotal score that can be combined for a total score or can be used for independent analysis (Table 17-1). In addition to the task-specific quantitative scores, a global assessment (by the patient and by the examiner) is also obtained at each visit, with the definitions provided on the scoring form (Fig. 17-1). The scoring form also is used for the execution of the writing and drawing tasks, and it serves as a convenient location for the examiner to record the ratings, list the medications, and make any comments.

#### Part A

Part A (scores 1 to 9) quantifies the tremor at rest, with posture holding, and with action and intention maneuvers, for nine parts of the body (Fig. 17-1). Naturally, some body parts would not normally have tremor in all three situations. For example, voice tremor is a tremor of action only, so the rating scale does not score voice tremor at rest or with posture. Since face, tongue, head, and trunk tremors are basically present at rest or with posture holding, this new scale eliminates scoring of those tremors in the action/intention category.

Severity of tremor in each of the nine body

parts is rated by amplitude. Whether the tremor is intermittent or always present (a phenomenologic characteristic of resting tremor in parkinsonism) is not a factor in the severity score. The definitions for tremor severity (Table 17-1, parts 1 to 9) indicate that 1+ and 2+ tremors could be either intermittent or continuous. Since larger amplitude tremors are less likely to be intermittent, the definitions for 3+ and 4+ severities do not list the choice for intermittency.

Tremor severity in Part A is rated for three situations: rest, maintaining a posture, and performing an activity (Fig. 17-1). Definitions for these three situations are provided for the limbs, tongue, head, and trunk (Table 17-1). Face tremor is scored only as a resting tremor. The lips (orbicularis oris) and chin (mentalis muscle) are the most common sites of face tremor and are affected in parkinsonism particularly, rather than in other types of tremors. The so-called rabbit syndrome in tardive dyskinesia might actually be a type of lip tremor. Tongue tremor at rest is scored with the tongue resting in the mouth; posture tremor is scored with the tongue maintained protruded from the mouth.

Voice tremor can be detected by listening to the patient talk, but it is sometimes difficult to differentiate by sound alone voice tremor and dystonic adductor dysphonia (so-called spastic dysphonia or spasmodic dysphonia). It is much easier to detect voice tremor and to distinguish it from dystonic dysphonia by having the patient utter a single sound, such as "aaahhh . . ." or "eeehhh . . ." and hold it for as long as possible. Voice tremor is rhythmic, whereas dystonic adductor dysphonia produces irregular interruptions of sound. Occasionally patients have both tremor and dysphonia.

Tremor of the head and of the trunk when the patient is sitting or standing is considered a postural tremor; rest tremor of the head or trunk is measured when the patient is lying down with the head and body supported against gravity.

Tremor of the arms and legs can be distal or proximal. Rest tremor of the limbs is assessed with the limbs in complete repose. Often this

#### Part A

NAME:

DIAGN

DATE:

1. F

2. T

3. V

4. H

5. R

6. L

7. T

8. R

9. L

10. H

11. D

12. D

13. D

14. P

FUNCTI

15. Sp

16. Ea

17. Dr

18. Hy

19. Dre

20. Wri

21. Wor



## Part A

NAME: \_\_\_\_\_ HOSP. #: \_\_\_\_\_  
 DIAGNOSIS: \_\_\_\_\_ AGE: \_\_\_\_\_ SEX: \_\_\_\_\_ R/L handed  
 DATE: \_\_\_\_\_

	Rest	Post.	Act./Int.	TOTAL
1. Face tremor			xxxxxx	
2. Tongue tremor			xxxxxx	
3. Voice tremor	xxxx	xxxxx		
4. Head tremor			xxxxxx	
5. RUE tremor				
6. LUE tremor				
7. Trunk tremor			xxxxxx	
8. RLE tremor				
9. LLE tremor				
SUBTOTAL A:				

List of  
Medications  
\_\_\_\_\_

10. Handwriting (dominant only)			
	right	left	TOTAL
11. Drawing A:			
12. Drawing B:			
13. Drawing C:			
14. Pouring			
SUBTOTAL B:			

Comments:  
\_\_\_\_\_

## FUNCTIONAL DISABILITIES DUE TO TREMOR

15. Speaking	
16. Eating	
17. Drinking	
18. Hygiene	
19. Dressing	
20. Writing	
21. Working	

SUBTOTAL C:

TOTAL SCORE: \_\_\_\_\_

Figure 17.1. Tremor rating scale.

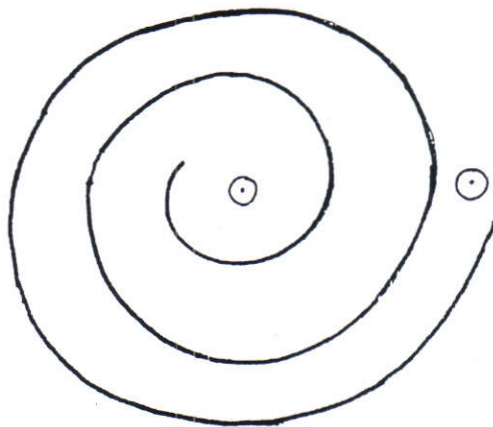
**Part B**

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

**HANDWRITING:** This is a sample of my best handwriting.  
Signature. Date.

**DRAWINGS:** with right/left hand

A.



B.

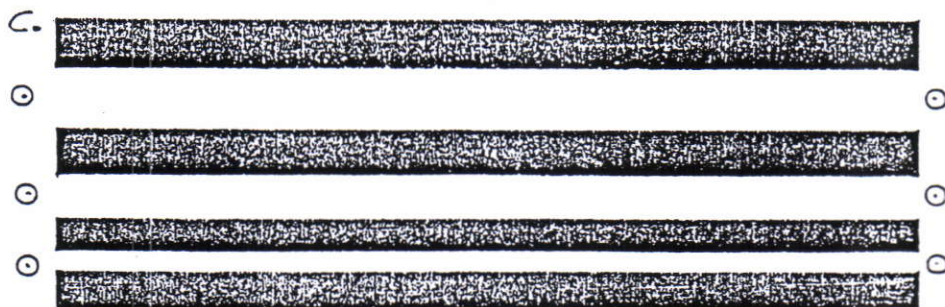
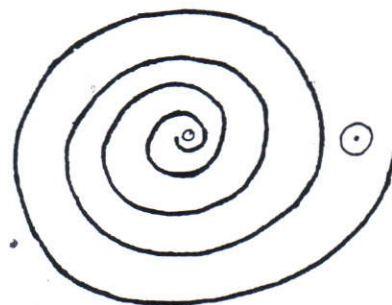


Figure 17.1. *Continued.*



## Part C

## CALCULATION

Total score/ max. possible score:                      /                      % SEVERITY  
(The maximum score possible is 144)

GLOBAL ASSESSMENT BY EXAMINER:                      (Examiner's initials:                      )

- 0 = No functional disability.
- 1 = Mild disability.                      1-24% impaired.
- 2 = Moderate disability.                      25-49% impaired.
- 3 = Marked disability.                      50-74% impaired.
- 4 = Severe disability.                      75-100% impaired.

SCORE: \_\_\_\_\_

GLOBAL ASSESSMENT BY PATIENT:

- 0 = No functional disability.
- 1 = Mild disability.                      1-24% impaired.
- 2 = Moderate disability.                      25-49% impaired.
- 3 = Marked disability.                      50-74% impaired.
- 4 = Severe disability.                      75-100% impaired.

SCORE: \_\_\_\_\_

SUBJECTIVE ASSESSMENT BY PATIENT COMPARED TO LAST VISIT:

- +3 = Marked improvement                      (50-100% improved)
- +2 = Moderate improvement                      (25-49% improved)
- +1 = Mild improvement                      (10-24% improved)
- 0 = Unchanged
- 1 = Mild worsening                      (10-24% worse)
- 2 = Moderate to marked worsening                      (25-49% worse)
- 3 = Marked worsening                      (50-100% worse)

Figure 17.1. Continued.



is easily accomplished when the patient is sitting, forearms and hands relaxing on the lap and feet supported by the floor. In individuals who are tense and cannot relax their muscles, one might have to assess for rest tremor of the limbs with the patient supine. Postural tremor of the arms is observed by having the patient stretch the arms in front of the body both with elbows extended and with elbows flexed (winged posture to look for 'wing-beating' tremor). Postural tremor of the legs is observed by having the patient elevate the legs, which is sometimes easiest if done one leg at a time. This can be accomplished with the patient sitting or lying. For ease and consistency in scoring, the sitting position is recommended. The hips and knees are flexed with the legs maintained in the air against gravity.

Action and intention tremor are given a single score. For the arms, the patient carries out the finger-to-nose maneuver as well as such other actions as buttoning, dialing a telephone, writing, and bringing a cup to the mouth. Some of these activities are rated separately in Parts B and C of the rating scale, giving additional weight to this type of tremor in the total tremor score. For the legs, action/intention tremor is assessed by having the patient carry out the toe-to-finger maneuver. Since postural tremor will be superimposed on top of action/intention tremor, it is important to determine if the activity results in a greater tremor amplitude than that seen with posture holding alone. Similarly, rest tremor can superimpose on top of posture tremor after the posture is maintained for several seconds. This resting component should not be misinterpreted as postural tremor.

### Part B

Part B (scores 10 to 14) relates to action tremors of the upper extremities, particularly writing and pouring liquids. Severity is determined by watching the patient carry out the aforementioned activities. For handwriting, only the dominant hand used for writing is evaluated; the patient writes a standard sentence, his or her name, and the date (Table 17-1, item 10). Space is provided on the scor-

ing form for this handwriting sample, which will then be part of the patient's record (Fig. 17-1). Drawing is also evaluated by having the patient carry out this activity on the scoring form. Space is available for assessing each hand. To allow consistent evaluation over time, the patient should not rest the drawing hand and forearm on the table or desk. This, of course, makes the task more difficult and the test more sensitive. Tasks A and B are the drawing of an Archimede's spiral. The quantitation of these tasks is defined in Table 17-1 (items 11 to 13) and is based on the crossing of the lines in the figure. There is less space available between the lines in Task B, making the task more difficult. Task C for drawing requires the patient to draw a straight line between narrow confines, three times; each time the confines become narrower, thereby increasing the difficulty. These three drawing tasks, by having different levels of difficulty, give a more precise reflection of tremor severity.

Pouring water from one cup to another is also quantified. Cup size and the amount of water used in the test are specified to ensure consistency between examination events and among clinicians. The amount of water spilled is the basis for the severity grading. The definitions for scoring both pouring and drawing are provided in Table 17-1 (items 10 to 14).

### Part C

Part C assesses functional disability. Its items evaluate the severity of tremor with speaking, eating (feeding), bringing liquids to the mouth, hygienic care, dressing, and working, including domestic tasks. These scores, with the exception of speaking, are provided by patients, who are asked to evaluate their ability to carry out these tasks by using the definitions provided in Table 17-1. Speaking can also be evaluated by the examiner. Since patients (and often physicians) cannot distinguish between dystonic adductor dysphonia and voice tremor, and since occasional patients have both disorders, the speaking score encompasses both disabilities. Definitions for



all rated functional tasks are provided in Table 17-1. "Working" classifications includes home-making, as well as other jobs.

### Calculations

Space is provided on the scoring form (Fig. 17-1) for calculating subtotal scores, i.e., sums of each separate part (A, B, and C), and an overall score of all three parts. The maximum possible scores are 80 for Part A, 36 for Part B, and 28 for Part C, making the maximum possible total score 144. For patients with amputated or immobile limbs, the maximum possible scores would be reduced appropriately. Page 2 of the scoring form explains how to calculate percent of severity. This is determined by dividing the total score by the maximum score possible and then multiplying by 100.

### Global Assessment

In addition to the quantitation of tremor through Parts A, B, and C, the scoring form allows assessment of overall severity by both the patient and the examiner. This subjective global severity is based on the assessment of tremor-related disability, which is calculated according to the percent of impairment in carrying out all activities of daily living and the cosmetic effect of the tremor, which can be psychologically damaging. Subjective global assessments are quick guides for evaluating patients, but they also provide useful comparisons for the quantitative ratings of Parts A, B, and C. The global assessments can serve as the 'gold standard' for validating this clinical rating scale.

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### Comparison Assessment

This rating scale should be useful for determining the effectiveness of medications or stereotactic surgery on reducing the severity of tremor. The scores obtained on Parts A, B, and C and the global assessments will provide the major input of a comparison before and after starting a new medication or having surgery. However, it is also useful to obtain subjective evaluations by the patient as to the effectiveness of medications or surgery. The scoring form provides definitions for the patient to carry out such a self-evaluation (Fig. 17-1).

### Summary

This chapter presents a new clinical rating scale for semiquantitating the severity of tremor in all its forms: at rest, with posture holding, and with action. No special tools are required, other than a pencil, paper, and two cups to hold water. The rating scale can be used to assess tremors of different etiologies. Standard sets of conditions and definitions for tremor severity are provided to help ensure consistency among examiners and also from one date of examination to another. A 5-point scale is used, and the maximum possible (total) score is 144 points. Functional disability and tremor amplitude are both assessed. Furthermore, definitions are provided to allow subjective global assessments of tremor, including subjective comparisons by the patient for evaluating the effectiveness of treatment attempts and variations in tremor severity over time. This rating scale needs to be statistically evaluated for validity and reliability.

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