Chapter 8

DUAL-TASK ASSESSMENT AND INTERVENTION

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REFERENCES

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DUAL-TASK ASSESSMENT AND INTERVENTION

Introduction

Persons with traumatic brain injury (TBI), and specifically with concussion/mild traumatic brain injury (c/mTBI), have been shown to have statistically significant slower gait speed and reduced stability under dual-task conditions compared to healthy controls.[1–3] These differences may be subtle and difficult to detect with simple clinical measures, but could be devastating for a deployed service member in a war zone and may affect reintegration into work and community environments. Issues related to assessment and intervention for postural control and attention issues, specifically in dual-task conditions following brain injury, have been reviewed.[4] Similarly, Al-Yahya[5] has published a systematic review of the use of dual-task methodology to assess cognitive motor interference that occurs while walking, and suggests the overall effect of cognitive tasks was most prominently detected in measures of gait speed.

There is a clear need to develop valid and reliable assessment tools to evaluate recovery and the effects of intervention on dual-task deficits after c/mTBI to establish definitive therapy assessment and treatment standards for both service members and the civilian patient population. Although a specific and appropriate dual-task test clearly relevant for service members with c/mTBI cannot be recommended at this time, some options are available. Dual-task "cost," or decrement in skill level (error) or time to complete a task when two or more tasks are done simultaneously could be monitored to assess recovery and the effect of intervention. The Functional Gait Assessment[6] is a clinical test of walking containing items that require patients to perform more than one task, such as walking while turning one's head or walking around objects. The Walking and Remembering Test (WART) has been shown to be reliable and feasible in persons with acquired brain injury.[7] A dual-task questionnaire[8] has only been used in one study, but may provide information on the average difficulty of everyday tasks that require dual tasking and may grossly identify persons who report dual-task difficulty.

Research on specific interventions for issues such as postural control, attention, and dual or multiple tasks in persons with c/mTBI is in its infancy, although small studies show using dual-task training methods in older adults may be useful to improve balance.[4,8,9] Early findings indicate the importance of training specificity. Therapists are encouraged to design individualized intervention strategies with military overtones (ie, obstacle courses, map reading, carrying a load, speed, visual scanning, time constraints) for service members who have attention deficits in dual-task situations. It is important to begin with simple interventions and move to more complex tasks as appropriate. When it is appropriate to progress, real-life tasks are encouraged and should involve functional skills for balance, gait, visual-spatial, and cognitive tasks trained in progressively more challenging dual-task conditions.

This section of the Toolkit provides assessments and interventions that are considered **practice options** based on the level of evidence available at this time. Therapists are encouraged to consider this area of assessment and intervention for those service members who obtain maximum scores on standard motor and cognitive assessment tools, yet still report deficits.

DUAL-TASK ASSESSMENT

Introduction

In a clinical setting, measures of dual-task performance typically involve using observation and readily available equipment, such as simple walkways, obstacle courses, stopwatches, objects to carry, and lists of rote cognitive tasks (alphabet, serial subtractions, simple questions to answer). Some physical therapy departments have dynamic posturography equipment (such as the Neurocom [Natus Medical Incorporated, Clackamas, OR] or Proprio [Perry Dynamics Proprio Reactive Balance Systems, Decatur, IL] systems) and can assess more sensitive measures of postural control (eg, postural sway) during different sensory conditions or while combining a cognitive task overlay. No dual-task test combinations have been validated in service members with c/mTBI, but several studies of individuals with sports concussion have described methods to detect dual-task performance problems. This dual-task assessment section provides some options for evaluating an individual service member. Testing in an evaluative way, by comparing baseline information to follow-up testing for an individual, is a reasonable approach. Guidelines to interpret individual results in comparison to group findings are not available at this time.

DUAL-TASK PERFORMANCE ASSESSMENTS

Purpose/Description

A number of measures have been suggested for measuring dual-task performance to assess how impairments in attention may affect performance in balance and walking in persons with brain injury, including the WART,[10] the Timed Up and Go (TUG; Cognitive) test,[11] and a walking and spoken sentence verification task.[8] In general, dual-task assessment involves measuring baseline performance on a single motor task (eg, time to complete fast walking for a specified distance) and measuring single-task performance on a cognitive task (eg, repeating the months of the year backwards from the current month, or serially subtracting 7 from 100). In the dual-task condition, both tasks are performed at the same time. This dual-task testing is used as an experimental approach in cognitive psychology to understand the processes of skilled performance,[12] but also has implications for real-life situations that require doing more than one thing at a time.

Recommended Instrument Use

The scenarios provided are examples of the concept. Alternate motor and cognitive tasks can be substituted as appropriate, but must be consistently applied for an individual subject. There is insufficient information on norms or retest reliability for young adults of military age to provide information on sensitivity, specificity, or minimal detectable change (MDC) of these types of scenarios.

It is important to remember that neurologically intact persons will show reductions in performance in dual-task versus single-task conditions if the task combination is sufficiently challenging. Individuals who have mTBI may also be able to successfully do two tasks at the same time without performance decrement if the two tasks are very simple (eg, standing still while listening to instructions). If, while under clinical observation, the clinician feels a service member shows evidence of attention impairments that may affect task performance, a dual-task assessment for the individual service member may be appropriate. This information could be used for follow-up testing and comparison for that individual. Group comparisons are not appropriate at this time.

Administration Protocol/Equipment/Time

Example protocols are shown below and require a stopwatch. Other requirements depend on task protocol. To quantify reductions in performance, dual-task costs can be calculated as a percentage (eg, 10% dual-task cost for walking speed). This calculation requires a baseline measurement of single-task performance so dual-task performance can be interpreted. Relative dual-task cost[4] can be figured by adjusting for single-task performance (control for slower or faster usual walking speed; Exhibit 8-1).

Ideally, dual-task costs are figured for both the motor and the cognitive task. Cognitive task performance may be computed by looking at accuracy of responses (eg, to serial subtraction or number of correct responses). If only motor dual-task costs are measured, it is possible that costs are occurring with the cognitive task and are undetected. Dual-task costs can occur in either or both of the two tasks.

Groups Tested With This Measure

Dual-task costs for walking and cognitive tasks have been measured in community-dwelling older adults.[5,10] A randomized controlled trial evaluated the effectiveness of a cognitive-motor dual-task training program in persons with acquired brain injury and used walking distance completed in 2 minutes or clicking a handheld mechanical counter while verifying the correctness of simple sentences (eg, "Dogs have wings." "Dogs have four legs.").[8] The TUG test was used under single-task versus dual-task conditions for identifying elderly individuals who are prone to falling. While the TUG test was found to be a sensitive and specific measure for identifying community-dwelling adults who are at risk for falls, the ability to predict falls was not enhanced by adding a secondary task to the TUG test.[11]

Interpretability

- Norms: not available for the specific tasks used in these examples. Young adults demonstrated relative dual-task costs for walking time at an average of 2% to 3% in a test of the WART,[10] whereas older adults had a reduction in walking speed of 4%. Digit span dual-task costs were on average 8% to 9% for younger adults and 15% for older adults in the WART.[10]

  In measures of anterior displacement (velocity in m/sec) of the center of mass during level walking comparing 15 college-aged volunteers who had sustained a concussion to 15 uninjured controls (all

EXHIBIT 8-1

EQUATION FOR FIGURING RELATIVE DUAL-TASK COST

$$DTCwalk = \frac{(DTwalk - STwalk)}{STwalk} \times 100$$

DT: dual task
DTC: dual-task cost
ST: single task

participants were involved in athletics and concussed participants had sustained a grade 2 concussion [symptoms lasting longer than 15 minutes without loss of consciousness]), the normal controls showed a dual-task cost of 5.7% while the concussed participants showed a 10.1% cost on day 2 following concussion. Single-task conditions involved walking with undivided attention, while dual-task conditions involved walking while simultaneously completing simple mental tasks, such as spelling five-letter words in reverse, subtraction by sevens, and reciting the months of the year in reverse order.[13] Dual-task deficits were retested at days 5, 14, and 28, and some deficits lingered.

- MDC: not available for this specific example. If the patient's score is less than the MDC value, it is considered indistinguishable from measurement error.
- Reliability estimates: not available for the example tasks used in this Toolkit
- Internal consistency: not available
- Interrater: Reliability for walking time in the WART (intraclass correlation coefficient [ICC] [2,1]) was .98 for younger adults and .99 for older adults.[10]
- Intrarater: not available
- Test-Retest: ICC (2,1) for young adults for single-task trials of walking a narrowed path were .83 to .92; for a dual-task trial of walking time, ICC was .76.[10]

Validity Estimates: not available for the example tasks used in this population

- Content/Face: not available
- Criterion: not available
- Construct: Older adults were slower and remembered shorter digit spans with greater dual-task costs than younger adults.[10]

Selected References

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DUAL-TASK COST EXAMPLE 1: WALKING AND REMEMBERING TEST[10]

Equipment/Set-Up

A walkway, stopwatch, and a list of single-digit random numbers (see below) are required. On a marked, narrowed, 7.5-inch-wide (19 cm), 20-foot-long (6.1 m) walkway, mark an additional 5 feet (.91 m) from the start and end of the walkway (total 30 ft) for acceleration and deceleration.

Step 1: Single-Task Walking (Fast Pace)

To determine the time it takes to walk a 7.5-inch-wide, 20-foot-long walkway at a fast pace, start the subject at the beginning of the acceleration zone and begin timing when the subject's first foot crosses the start line marker onto the walking path. Finish timing when the subject's front foot crosses the finish line. Ask the subject to walk as fast as he or she can between the tape lines and to keep his or her feet between the lines until reaching the cone (or other object) at the end of the deceleration zone. Remind the subject to:

- keep feet between the tape lines (the trial does not count if the subject's foot touches the tape line more than twice during the trial), and
- avoid running; this is a test of fast walking.

Record the time to the tenths of a second. Record the average of two trials:

Trial 1 (sec)______ Trial 2 (sec)______ Average ______

Step 2: Digit Span Testing

The purpose of this step is to determine the longest digit span the subject can recall after a delay equivalent to the average time to walk in the single-task condition (Step 1, above). The longest digit span correct for at least one trial is used in the dual-task condition and is considered to be 100% correct for assessing cognitive errors. Discontinue testing after the patient scores 0 correct on both trials (Table 8-1). Administer both trials of each item even if the patient passes trial 1. Score 0 to 1 point for each response.

Give the patient the following instructions: "I'm going to say some numbers that I want you to remember after a brief delay. Listen carefully to the numbers, and use any method except writing or talking to help you remember them. When I give you the cue 'now,' repeat the numbers to me."

Take longest digit span correct after the time delay (in seconds, determined in Step 1) for at least one trial to use in Step 3.

dual-task condition: ______________ (number of digits)

Step 3: Dual-Task Walking (Fast Pace)

Use the longest digit string (from Step 2) the subject was able to recall at least once with the time delay (from Step 1) for the dual-task testing, then combine the two tasks. Give the patient the following instructions:

> "Now we are going to combine walking with remembering numbers. We will do this task twice. I am going to say some numbers that I want you to remember until we get to the end of the walking path. You may use any method you choose to remember the numbers, except saying them out loud. Walk as quickly as you can but take care not to step off the path. I will walk beside you and time you from when you first step onto the path. Continue walking until I say 'now,' then repeat the numbers you have been concentrating on while you were walking."

TABLE 8-1

DIGIT SPAN TESTING

Item/Trial	Response: Record subject's response after time delay (to nearest second)* ___________ seconds	Score
1. Trial 1	6-4-3-9	
Trial 2	7-2-8-6	
2. Trial 1	4-2-7-3-1	
Trial 2	7-5-8-3-6	
3. Trial 1	6-1-9-4-7-3	
Trial 2	3-9-2-4-8-7	
4. Trial 1	5-9-1-7-4-2-8	
Trial 2	4-1-7-9-3-8-6	
5. Trial 1	5-8-1-9-2-6-4-7	
Trial 2	3-8-2-9-5-1-7-4	
6. Trial 1	2-7-5-8-6-2-5-8-4	
Trial 2	7-1-3-9-4-2-5-6-8	
	Total score	

*Determined from average of two trials in single-task walking (fast pace).

Present the number of digits from the list below that the subject can recall from digit span testing above (eg, you would say "5 1 9 6 3" if the patient can recall five digits above.)

Trial 1 Digits presented: 5 1 9 6 3 8 4 1 9 3
Digits recalled: ______________
Steps off path: ______________
Seconds to complete trial (to tenths of second): ______________

Trial 2 Digits presented: 8 7 1 9 2 4 3 6 9 5
Digits recalled: ______________
Steps off path: ______________
Seconds to complete trial (to tenths of second): ______________

Note: If space considerations warrant, any standard distance can be used, with markers at the start and finish line, and 3 to 5 feet before for acceleration and deceleration. A standard distance must be used consistently with each patient to make comparisons over time. Also, if the subject can only recall two or three digits correctly, use that number in the dual-task trial and consider it 100%.

Example Calculations

Single-task (from Step 2) walking speed 20 ft (6.1 m):
Trial 1: 9.5 sec Trial 2: 9.1 sec
Average (STwalk;): 9.3 sec

Dual-task (from Step 3) walking speed 20 ft (6.1 m):
Trial 1: 10.5 sec Trial 2: 10.3 sec
Average (DTwalk;): 10.4 sec

$$\text{DTCwalk} = \frac{(10.4 - 9.3)}{9.3} \times 100;\ \text{DTCwalk} = 11.8\%$$

DUAL-TASK EXAMPLE 2: COGNITIVE ERROR DURING WALKING AND REMEMBERING TEST

Using the number of digits that the subject repeated correctly in Step 2 above as 100%, determine the number of digits that the subject repeated correctly after the combined fast-walking and digit-span recall from Step 3 above.

Note: Subjects sometimes get partial spans correct. Partial credit can be given if:

- first or last digit is correct,
- any digits adjacent to first or last digit are correct, or
- there is a correct sequence of three anywhere in span.

Example Calculations

Subject A was able to recall seven digits from Step 2; therefore, that number becomes 100%. If, during Step 3, the subject is able to recall only six of the seven presented numbers (missing any number in the span), his or her dual-task cost is calculated by the following:

6/7 × 100 = 85.7% correct in the dual-task condition

Therefore, the dual-task cost is 100% – 85.7%; or 14.3%.

Subject B was able to recall nine digits from Step 2; therefore that number becomes 100%. During Step 3, the subject recalls the nine-digit span as follows:

Correct: 3-7-4-8-1-6-2-9-3
Patient recall: 3-7-8-4-1-6-2-3

The first two are correct (3, 7), the second two transposed (both incorrect), the next three correct (1, 6, 2), one digit is omitted (9), and the last is correct (3). Therefore, the total number of correct digits is 6/9, or 67% correct.

DUAL-TASK ASSESSMENT EXAMPLE 3: TANDEM WALK WITH COGNITIVE TASK

Ask the subject to walk heel to toe as fast as possible down a 20-foot (6.1 m) tape line, instructing the subject to make sure to touch heel to toe and stay on the tape. Ask the subject to turn at the end of the line and walk heel to toe as fast as possible back to the starting point. Begin timing when the subject's first foot touches the tape line and finish timing when the subject's first foot steps off the tape line at the beginning. Record the time to the tenths of a second and take the average of two trials. Ask the subject to repeat the phonetic alphabet (Table 8-2) to ensure the service member can complete the cognitive task in a single-task condition. Then combine the two tasks and record the average of two trials. For the trial to count, the service member may make no more than two steps that are not heel to toe.

Standardized Start Line Instructions

Step 1: Single Task Tandem Walking

Give the subject the following instructions:

> "Walk heel to toe as fast as you can safely walk to the end of the tape, turn, and return to walk off the end of the tape on this end of the line. Try to keep your feet on the tape line and make sure the heel of one foot touches the toe of the other foot all the way down the line. Go as fast as you can. Ready . . . Begin."

Trial 1 (sec)______ Trial 2 (sec)______ Average______

Step 2: Cognitive Task

Give the patient the following instructions: "Recite the phonetic alphabet." If the service member cannot correctly recite the phonetic alphabet, another cognitive task should be substituted to ensure the cognitive task can be accomplished in a single-task condition. Repeating the phonetic alphabet backwards could also be substituted.

Step 3: Dual-Task Tandem Walking

Give the patient the following instructions:

> "Now I would like you to combine these two tasks. Remember, please walk heel to toe down the tape line as fast as you can safely walk to the end of the line, turn, and return to this end of the tape. Keep your feet on the line, go as fast as you can, *and* recite the phonetic alphabet. Remember to speak loud enough so I can hear you, and start over reciting the alphabet if you finish before you are done walking. Ready . . . Begin."

Trial 1 (sec)______ Trial 2 (sec)______ Average______

Note: If space considerations warrant, any standard distance can be used, but the standard distance must be used consistently with each patient to make comparisons over time.

TABLE 8-2

PHONETIC ALPHABET

Letter	Phonetic letter
A	Alpha
B	Bravo
C	Charlie
D	Delta
E	Echo
F	Foxtrot
G	Golf
H	Hotel
I	India
J	Juliet
K	Kilo
L	Lima
M	Mike
N	November
O	Oscar
P	Papa
Q	Quebec
R	Romeo
S	Sierra
T	Tango
U	Uniform
V	Victor
W	Whiskey
X	X-ray
Y	Yankee
Z	Zulu

Example Calculations

Single-task tandem walking speed 40 ft (12.2 m):
Trial 1: <u>16.7sec</u> Trial 2: <u>16.5 sec</u>
Average (STwalk;): <u>16.6 sec</u>

Dual-task tandem walking speed 40 ft (12.2 m):
Trial 1: <u>17.6 sec</u> Trial 2: <u>17.0 sec</u>
Average (DTwalk;): <u>17.3 sec</u>

$$DTCwalk = \frac{(17.3\text{-}16.6)}{16.6} \times 100 \text{ ; } DTCwalk = 4.2\%$$

This example would indicate a 4.2% slower tandem walking speed under dual-task conditions.

DUAL-TASK QUESTIONNAIRE

Purpose/Description

The dual-task questionnaire is used to obtain information relating to everyday difficulties with dual tasking.

Recommended Instrument Use

This questionnaire has only been used in one study. It does appear to give information on the average difficulty of everyday tasks that require dual tasking and may grossly identify persons who report dual-task difficulty. It should not be used to follow change over time until further evaluated psychometrically.

Administration Protocol/Equipment/Time

This is a brief, 10-question, pencil-and-paper survey that should take less than 2 to 3 minutes (Form 8-1).

Groups Tested With This Measure

This measure has been used in people with dual-tasking difficulties arising from acquired brain injury (stroke and TBI) between 6 and 280 months following injury with a range of premorbid intellectual abilities.[8]

Interpretability

The average questionnaire response in persons with acquired brain injury who underwent a 5-week, cognitive-motor dual-tasking training program improved from 2.09 (standard deviation 0.68) to 1.71 (standard deviation 0.56) using a 5-point, 0-to-4 scale, with a "4" indicating very often and a "0" indicating never.[8]

- Norms: not available
- MDC: not available. If the patient's score is less than the MDC value, it is considered indistinguishable from measurement error.

Reliability Estimates

- Internal consistency: not applicable
- Interrater: not available
- Intrarater: not available
- Test-Retest: a control group of persons with acquired brain injury (stroke and TBI) between 6 and 280 months after injury with a range of premorbid intellectual abilities ($r = 0.69$)[8]

Validity Estimates

- Content/Face: Questions include tasks with which everyone experiences difficulty from time to time.[8]
- Criterion: not available
- Construct: control group of persons with acquired brain injury (stroke and TBI) between 6 and 280 months after injury with a range of premorbid intellectual abilities showed no evidence of a difference between test occasions ($P = 0.752$). Subjects who underwent a 5-week, cognitive-motor dual-tasking training program showed a significant improvement in average questionnaire response ($P < 0.10$),[8] although the difference was not significant after intention to treat analysis.

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Evans JJ, Greenfield E, Wilson BA, Bateman A. Walking and talking therapy: improving cognitive-motor dual-tasking in neurological illness. *J Int Neuropsychol Soc.* Jan 2009;15(1):112–120.

SECTION 2: DUAL-TASK INTERVENTION

Purpose/Background

Although impairments in motor/postural and cognitive components of dual-task performance are recognized in individuals with c/mTBI, research on specific interventions for the issues of attention and dual or multiple tasks in these individuals is in its infancy.[4,8,9] Early findings seem to indicate the importance of training specificity; that is, the ability to generalize from one type of dual-task training (eg, a cognitive-motor task versus two motor tasks) has not been found consistently.[8] Training in the combination of cognitive and motor tasks together does seem to offer benefits over single-task balance training and may transfer to a cognitive-motor test that has not been practiced.[14,15]

Experts suggest that training scenarios be tasks relevant to the real-life home and occupational situations for each individual. Suggested interventions include tasks carried out in progressively more complex environments and under increasingly more difficult multitask conditions. Interventions should involve motor, manual, visual-spatial, and cognitive tasks, with a goal of assisting the service member in improving his or her ability to perform everyday tasks in complex environments. Summary

FORM 8-1

DUAL-TASKING QUESTIONNAIRE

The following questions are about problems that everyone experiences from time to time, but some of which happen more often than others. We want to know how often these things have happened to you **in the past few weeks**. There are five options, ranging from ***very often*** to ***never***, or ***not applicable (N/A)***. Please circle the appropriate response.

Do you have any of these difficulties?

1. Paying attention to more than one thing at a time.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

2. Needing to stop an activity to talk.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

3. Being unaware of others speaking to you when doing another activity.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

4. Following or taking part in a conversation where several people are speaking at once.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

5. Walking deteriorating when you are talking or listening to someone.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

6. Busy thinking your own thoughts, so not noticing what is going on around you.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

7. Spilling a drink when carrying it.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

8. Spilling a drink when carrying it and talking at the same time.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

9. Bumping into people or dropping things if doing something else as well.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

10. Difficulty eating and watching television or listening to the radio at the same time.

very often (4) often (3) occasionally (2) rarely (1) never (0) N/A

Total Score = _____.
Sum of 1–10/10
Total is average rating per question

feedback given to patients on their performance with regard to number of errors (ie, number targets not identified or number of balance losses) and information on their performance (ie, distractions seen as the reason for their loss of balance) may be helpful in providing insight on safety issues and areas for improvement.

Strength of Recommendation: Practice Option

Preliminary evidence has shown training-specific improvement in cognitive-motor and balance tasks in community-dwelling adults at risk for falls[9] and those with acquired brain injury.[8] The use of sports or activities such as t'ai chi ch'uan to improve dual-task abilities have been suggested,[4] although efficacy findings are mixed.[16]

EXHIBIT 8-2

SECONDARY TASKS IN TRAINING PROGRAMS

1. **Auditory discrimination tasks:** Patients were asked to identify the noises or voices from a compact disc such as:
   1) Identifying voices (man, woman, child)
   2) Identifying noises (hand clap, door close, dog bark, cat meow)
2. **Name things/words:** Patients were asked to name things such as types of flower, states, and men's names.
3. **Visual discrimination tasks:** Patients were shown the pictures before and after performing the balance tasks. They were asked to memorize the pictures and to respond if the pictures were the same. They were required to say "yes" if the pictures were the same and "no" if they were different.
4. **Random digit generation:** Patients were asked to randomly name the numbers between 0 and 300.
5. **Counting backward:** (eg, by twos, threes).
6. **Visual spatial task:** Patients were asked to place numbers, objects, or letters in the imagined matrixes. Then they were required to name the numbers, objects, or letters in the specific matrix cell.
7. **Visual imaginary spatial tasks:** Patients were asked to imagine and tell the road direction (eg, the road direction from their home to the post office).
8. **N-Back task:** Patients were asked to recite numbers, days, or months backward (eg, December, November, . . . January).
9. **Subtract or add number to letter:** Patients were asked to give the letter as a result of the equation (eg, k–1=j).
10. **Remembering things:** Patients were asked to memorize telephone numbers, prices, objects, or words.
11. **Tell story:** Patients were asked to tell any story such as what they did in the morning, what they did on their vacation, and so on.
12. **Tell opposite direction of action:** Patients were asked to name the opposite direction of their actions. For example, they were required to name "left" when they move their right leg.
13. **Spell the word backward:** Patients were asked to spell a word backward such as "apple," "bird," and "television."
14. **Say any complete sentence:** Patients were asked to say any complete sentence.
15. **Stroop task:** Patients were asked to name the color of the ink while ignoring the meaning of the word.

TABLE 8-3

EXAMPLE OF DUAL-TASK TRAINING WHILE VARYING INSTRUCTIONAL SET

			Balance (no. of missteps)		Verbal Responses	
	Secondary Activities	**Focus B/S***	**Left**	**Right**	**No. of Responses**	**No. of Errors**
Balance Activities						
Stance Activities						
1. Semi-tandem, eyes open, alternation	Spell words forward	80/20				
2. Semi-tandem, eyes closed arm alternation	Spell words backward	20/80				
3. Draw letter with right foot	Name any words that start with letter A–K	20/80				
4. Draw letters with left foot	Name any words that start with letter L–X	80/20				
5. Perturbed standing holding a ball	Remember prices (eg, bill payment)	20/80				
6. Perturbed standing holding a ball	Remember prices (eg, groceries)	80/20				
Transitional Activities						
Gait Activities						
7. Walk, narrow base of support	Count backward by 3	80/20	0	6	25	0
8. Walk, narrow base of support	Count backward by 3	20/80	7	27	28	0
9. Walk, narrow base of support, step sideways, backward avoiding the obstacles (holding a basket)	Remember words	80/20				
10. Walk, narrow base of support, step sideways, backward avoiding the obstacles (holding a basket)	Remember words	20/80				
11. Walk and kick a ball to hit the cans	Tell the opposite direction of the ball	20/80				
12. Walk and kick a ball to hit the cans	Tell the opposite direction of the ball	80/20				
13. Walk and reach and trunk twisting	Visual imaginary task (tell the road direction from home to the lab)	80/20				

*Focus B/S: focus on balance activities/secondary tasks (80/20: focus on balance activities; 20/80: focus on secondary tasks).
Reproduced with permission from: Silsupadol P, Siu KC, Shumway-Cook A, Woollacott MH. Training of balance under single- and dual-task conditions in older adults with balance impairment. *Phys Ther*. 2006; 86(2):269–281, Appendix 3, p 281.

Intervention Methods

Several intervention methods can be used to improve dual tasking, including the following:

1. Provide practice opportunities and training in motivating interventions that involve dual-task activities. Include tasks that begin with simple combinations of postural control (balance and gait with cognitive tasks; see Exhibit 8-2 and Table 8-3) and cognitive and visual-spatial tasks and advance to progressively more complex environments and progressively more difficult multitasking conditions.

2. If using dual-task activities in training, vary the priority the service member puts on the tasks that are combined, a concept referred to as "instructional set" because it is generated by the therapist's instructions. Requiring a shift in attention from one task to another as directed by the therapist may improve overall "dual-task" abilities based on early intervention studies with older adults.[14] Guide this shift in attention by cues such as "this time really focus on the balance task," then "this time really concentrate on getting the cognitive task correct."
3. Progress practice opportunities to tasks that are related to the individual's specific occupational environment and to the roles that an individual is expected to resume.
4. Encourage participation in and provide education about the types of recreational sport and leisure activities that involve multiple task performance while maintaining a service member's attention and motivation.
5. See the "Points to Remember" sheet, which is included for therapists designing dual-task intervention programs.

DUAL-TASK INTERVENTIONS: THERAPIST POINTS TO REMEMBER

- Dual-task learning is likely task specific. Although there may be some generalization to similar tasks, it is important to focus on the specific types of dual tasks that need to be improved. For example, if visual-spatial tasks (scanning the environment) while under challenging postural conditions (uneven terrain) is a relevant task, the intervention strategies should be designed for those conditions.
- According to McCulloch, "The ability to generalize novel dual-task conditions to real life has not been demonstrated for patients with neurological involvement, so choosing therapy activities that are closer to real life is a reasonable approach; walking while dialing (and talking) on a cell phone, map reading, . . . way finding."[4(p116)]
- Training in single-task conditions (ie, balance) has not been shown to improve dual-task skills (ie, balance and cognitive tasks combined).
- Progress the cognitive load from simple cognitive tasks to more complex tasks and from stable postural or gait tasks to more challenging situations once the simpler tasks have been mastered.
- The "instructional set" is important; that is, it is important to set up the directions or instruction for the patient as to the focus of their attention (ie, does the patient focus on the balance or postural control task, on the cognitive task, or on both tasks equally?). Vary the "instructional set" during training.
- Providing external (extrinsic) feedback on errors and successes may improve service member learning.
- Consider the person's long-term goals, targeting environments and roles that a patient is expected to resume.
- Possible interventions strategies:
  - Tasks with military overtones, obstacle courses, map reading, carrying a load, speed changes, visual scanning, altered terrain.
  - Recreational (non-contact) sports, such as ping-pong, tennis, basketball, bicycling, or tai chi. Consider water-based therapy programs.
  - Simulators or virtual-reality based games (eg, Nintendo Wii) that involve postural control with visual scanning and upper extremity motor tasks.

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