



Military Acute Concussion Evaluation (MACE)

Defense and Veterans Brain Injury Center

Patient Name: _____

SS#: _____ - _____ - _____ Unit: _____

Date of Injury: ____/____/____ Time of Injury: _____

Examiner: _____

Date of Evaluation: ____/____/____ Time of Evaluation: _____

History: (I – VIII)

I. Description of Incident

Ask:

- What happened?
- Tell me what you remember.
- Were you dazed, confused, “saw stars”? Yes No
- Did you hit your head? Yes No

II. Cause of Injury (Circle all that apply):

- Explosion/Blast
- Blunt object
- Motor Vehicle Crash
- Fragment
- Fall
- Gunshot wound
- Other _____

III. Was a helmet worn? Yes No Type _____

IV. Amnesia Before: Are there any events just BEFORE the injury that are not remembered? (Assess for continuous memory prior to injury)

Yes No If yes, how long _____

V. Amnesia After: Are there any events just AFTER the injuries that are not remembered? (Assess time until continuous memory after the injury)

Yes No If yes, how long _____

VI. Does the individual report loss of consciousness or “blacking out”? Yes No If yes, how long _____

VII. Did anyone observe a period of loss of consciousness or unresponsiveness? Yes No If yes, how long _____

VIII. Symptoms (circle all that apply)

- Headache
- Dizziness
- Memory Problems
- Balance problems
- Nausea/Vomiting
- Difficulty Concentrating
- Irritability
- Visual Disturbances
- Ringing in the ears
- Other _____



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Examination: (IX – XIII)

Evaluate each domain. Total possible score is 30.

IX. Orientation: (1 point each)

| | | |
|--------------|---|---|
| Month: | 0 | 1 |
| Date: | 0 | 1 |
| Day of Week: | 0 | 1 |
| Year: | 0 | 1 |
| Time: | 0 | 1 |

Orientation Total Score _____/5

X. Immediate Memory:

Read all 5 words and ask the patient to recall them in any order. Repeat two more times for a total of three trials. (1 point for each correct, total over 3 trials)

| List | Trial 1 | Trial 2 | Trial 3 |
|-------------|---------|---------|---------|
| Elbow | 0 1 | 0 1 | 0 1 |
| Apple | 0 1 | 0 1 | 0 1 |
| Carpet | 0 1 | 0 1 | 0 1 |
| Saddle | 0 1 | 0 1 | 0 1 |
| Bubble | 0 1 | 0 1 | 0 1 |
| Trial Score | | | |

Immediate Memory Total Score _____/15

XI. Neurological Screening

As the clinical condition permits, check

Eyes: pupillary response and tracking

Verbal: speech fluency and word finding

Motor: pronator drift, gait/coordination

Record any abnormalities. **No points are given for this.**



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XII. Concentration

Reverse Digits: (go to next string length if correct on first trial. Stop if incorrect on both trials.) 1 pt. for each string length.

| | | | |
|-------------|-------------|---|---|
| 4-9-3 | 6-2-9 | 0 | 1 |
| 3-8-1-4 | 3-2-7-9 | 0 | 1 |
| 6-2-9-7-1 | 1-5-2-8-5 | 0 | 1 |
| 7-1-8-4-6-2 | 5-3-9-1-4-8 | 0 | 1 |

Months in reverse order: (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sep-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan

0 1

Concentration Total Score ____/5

XIII. Delayed Recall (1 pt. each)

Ask the patient to recall the 5 words from the earlier memory test (Do NOT reread the word list.)

| | | |
|--------|---|---|
| Elbow | 0 | 1 |
| Apple | 0 | 1 |
| Carpet | 0 | 1 |
| Saddle | 0 | 1 |
| Bubble | 0 | 1 |

Delayed Recall Total Score ____/5

TOTAL SCORE ____/30

Notes: _____

Diagnosis: (circle one or write in diagnoses)

No concussion

850.0 Concussion without Loss of Consciousness (LOC)

850.1 Concussion with Loss of Consciousness (LOC)

Other diagnoses _____

Defense & Veterans Brain Injury Center

1-800-870-9244 or DSN: 662-6345



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Instruction Sheet

Purpose and Use of the MACE

A concussion is a mild traumatic brain injury (TBI). The purpose of the MACE is to evaluate a person in whom a concussion is suspected. The MACE is used to confirm the diagnosis and assess the current clinical status.

Tool Development

The MACE has been extensively reviewed by leading civilian and military experts in the field of concussion assessment and management. While the MACE is not, yet, a validated tool, the examination section is derived from the *Standardized Assessment of Concussion (SAC)* (McCrea, M., Kelly, J. & Randolph, C. (2000). *Standardized Assessment of Concussion (SAC): Manual for Administration, Scoring, and Interpretation.* (2nd ed.) Waukesa, WI: Authors.) which is a validated, widely used tool in sports medicine. Abnormalities on the SAC correlate with formal comprehensive neuropsychological testing during the first 48 hours following a concussion.

Who to Evaluate

Any one who was dazed, confused, "saw stars" or lost consciousness, even momentarily, as a result of an explosion/blast, fall, motor vehicle crash, or other event involving abrupt head movement, a direct blow to the head, or other head injury is an appropriate person for evaluation using the MACE.

Evaluation of Concussion

History: (I – VIII)

- I. Ask for a description of the incident that resulted in the injury; how the injury occurred, type of force. Ask questions A – D.
- II. Indicate the cause of injury
- III. Assess for helmet use. Military: Kevlar or ACH (Advanced Combat Helmet). Sports helmet, motorcycle helmet, etc.
- IV – V** Determine whether and length of time that the person wasn't registering continuous memory both **prior** to injury and **after** the injury. Approximate the amount of time in seconds, minutes or hours, whichever time increment is most appropriate. For example, if the assessment of the patient yields a possible time of 20 minutes, then 20 minutes should be documented in the "how long?" section.
- VI – VII** Determine whether and length of time of **self reported** loss of consciousness (LOC) or **witnessed/observed** LOC. Again, approximate the amount of time in second, minutes or hours, whichever time increment is most appropriate.
- VIII** Ask the person to report their experience of each specific symptom since injury.



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Examination: (IX – XIII)

Standardized Assessment of Concussion (SAC):

Total possible score = 30

Orientation = 5

Immediate Memory = 15

Concentration = 5

Memory Recall = 5

IX Orientation: Assess patients awareness of the accurate time

Ask: WHAT MONTH IS THIS?

WHAT IS THE DATE OR DAY OF THE MONTH?

WHAT DAY OF THE WEEK IS IT?

WHAT YEAR IS IT?

WHAT TIME DO YOU THINK IT IS?

One point for each correct response for a total of 5 possible points. It should be noted that a correct response on time of day must be within 1 hour of the actual time.

X Immediate memory is assessed using a brief repeated list learning test. Read the patient the list of 5 words once and then ask them to repeat it back to you, as many as they can recall in any order. Repeat this procedure 2 more times for a total of 3 trials, even if the patient scores perfectly on the first trial.

Trial 1: I'M GOING TO TEST YOUR MEMORY, I WILL READ YOU A LIST OF WORDS AND WHEN I AM DONE, REPEAT BACK AS MANY WORDS AS YOU CAN REMEMBER, IN ANY ORDER.

Trial 2 & 3: I AM GOING TO REPEAT THAT LIST AGAIN. AGAIN, REPEAT BACK AS MANY AS YOU CAN REMEMBER IN ANY ORDER, EVEN IF YOU SAID THEM BEFORE.

One point is given for each correct answer for a total of 15 possible points.

XI Neurological screening

Eyes; check pupil size and reactivity.

Verbal: notice speech fluency and word finding

Motor: pronator drift- ask patient to lift arms with palms up, ask patient to then close their eyes, assess for either arm to "drift" down. Assess gait and coordination if possible. Document any abnormalities.

No points are given for this section.



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XII Concentration: Inform the patient:

I'M GOING TO READ YOU A STRING OF NUMBERS AND WHEN I AM FINISHED, REPEAT THEM BACK TO ME BACKWARDS, THAT IS, IN REVERSE ORDER OF HOW I READ THEM TO YOU. FOR EXAMPLE, IF I SAY 7-1-9, YOU WOULD SAY 9-1-7.

If the patient is correct on the first trial of each string length, proceed to the next string length. If incorrect, administer the 2nd trial of the same string length. Proceed to the next string length if correct on the second trial. Discontinue after failure on both trials of the same string length. Total of 4 different string lengths; **1** point for each string length for a total of **4** points.

NOW TELL ME THE MONTHS IN REVERSE ORDER, THAT IS, START WITH DECEMBER AND END IN JANUARY.

1 point if able to recite ALL months in reverse order.

0 points if not able to recite ALL of them in reverse order.

Total possible score for concentration portion: **5**.

XIII Delayed Recall

Assess the patient's ability to retain previously learned information by asking he/she to recall as many words as possible from the initial word list, without having the word list read again for this trial. DO YOU REMEMBER THAT LIST OF WORDS I READ A FEW MINUTES EARLIER? I WANT YOU TO TELL ME AS MANY WORDS FROM THE LIST AS YOU CAN REMEMBER IN ANY ORDER.

One point for each word remembered for a total of 5 possible points.

Total score= Add up from the 4 assessed domains: immediate memory, orientation, concentration and memory recall.

Significance of Scoring

In studies of non-concussed patients, the mean total score was 28. Therefore, a score less than 30 does not imply that a concussion has occurred. Definitive normative data for a "cut-off" score are not available. However, scores below 25 may represent clinically relevant neurocognitive impairment and require further evaluation for the possibility of a more serious brain injury. The scoring system also takes on particular clinical significance during serial assessment where it can be used to document either a decline or an improvement in cognitive functioning.

Diagnosis

Circle the ICD-9 code that corresponds to the evaluation. If loss of consciousness was present, then circle 850.1. If no LOC, then document 850.0. If another diagnosis is made, write it in.



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MACE Form B

Due to test- retest issues (e.g. service members memorizing words and numbers) validated, alternative versions B or C should be used.

Immediate Memory

Read all 5 words and ask the patient to recall them in any order. Repeat two more times for a total of three trials. (1 point for each correct, total over 3 trials.)

| List | Trial 1 | Trial 2 | Trial 3 |
|----------|---------|---------|---------|
| Candle | 0 1 | 0 1 | 0 1 |
| Paper | 0 1 | 0 1 | 0 1 |
| Sugar | 0 1 | 0 1 | 0 1 |
| Sandwich | 0 1 | 0 1 | 0 1 |
| Wagon | 0 1 | 0 1 | 0 1 |
| Total | | | |

Concentration

Reverse Digits: (go to next string length if correct on first trial. Stop if incorrect on both trails.) 1 pt. for each string length.

| | | | |
|-------------|-------------|---|---|
| 5-2-6 | 4-1-5 | 0 | 1 |
| 1-7-9-5 | 4-9-6-8 | 0 | 1 |
| 4-8-5-2-7 | 6-1-8-4-3 | 0 | 1 |
| 8-3-1-9-6-4 | 7-2-4-8-5-6 | 0 | 1 |

Delayed Recall (1 pt each)

Ask the patient to recall the 5 words from the earlier memory test (DO NOT reread the word list.)

| | |
|----------|-----|
| Candle | 0 1 |
| Paper | 0 1 |
| Sugar | 0 1 |
| Sandwich | 0 1 |
| Wagon | 0 1 |



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MACE Form C

Due to test- retest issues (e.g. service members memorizing words and numbers) validated, alternative versions B or C should be used.

Immediate Memory

Read all 5 words and ask the patient to recall them in any order. Repeat two more times for a total of three trials. (1 point for each correct, total over 3 trials.)

| List | Trial 1 | Trial 2 | Trial 3 |
|---------|---------|---------|---------|
| Baby | 0 1 | 0 1 | 0 1 |
| Monkey | 0 1 | 0 1 | 0 1 |
| Perfume | 0 1 | 0 1 | 0 1 |
| Sunset | 0 1 | 0 1 | 0 1 |
| Iron | 0 1 | 0 1 | 0 1 |
| Total | | | |

Concentration

Reverse Digits: (go to next string length if correct on first trial. Stop if incorrect on both trials.) 1 pt. for each string length.

| | | | |
|-------------|-------------|---|---|
| 1-4-2 | 6-5-8 | 0 | 1 |
| 6-8-3-1 | 3-4-8-1 | 0 | 1 |
| 4-9-1-5-3 | 6-8-2-5-1 | 0 | 1 |
| 3-7-6-5-1-9 | 9-2-6-5-1-4 | 0 | 1 |

Delayed Recall (1 pt each)

Ask the patient to recall the 5 words from the earlier memory test (DO NOT reread the word list.)

| | | |
|---------|---|---|
| Baby | 0 | 1 |
| Monkey | 0 | 1 |
| Perfume | 0 | 1 |
| Sunset | 0 | 1 |
| Iron | 0 | 1 |