**APPENDICES**

**appendix 1 – literature search**

Literature search using MEDLINE and EMBASE was performed using the terms below from conception to February 2018. This was to establish what literature existed about concussion assessment in the ED and in sport. The information from this search was used as the basis for the introduction.

Terms:

“Concussion” OR “concussed” OR “concus\*” OR “mild TBI”

AND

“Sport\*” OR “sports related” OR “emergency department” OR “emergency room”

AND

“Assess\*” OR “management” OR “treatment” OR “diagnosis”

This search produced 4914 papers; of which relevant papers were identified by scanning titles and then abstracts. Papers were deemed relevant if they met the inclusion criteria and was decided by the Student. The cited articles and references of any relevant papers were also screened.

Inclusion criteria:

* Primarily investigated concussion assessment
* Setting in sports/at pitch side in athletes who have suffered a head injury or in an emergency department setting in patients presenting with a head injury
* Investigated concussion treatment, management, diagnosis in any of these settings
* Described or investigated concussion complications

**appendix 2 – acute concussion management and graduated return to play guidelines**

Concussion should be recognised using the SCAT5 and any player suspected of concussion should be removed from the field of play[7]. Re-evaluation should occur off the pitch in the doctor’s office or emergency room, including a complete history and clinical examination[7]. They should then rest for 24-48 hours ensuring any daily activities they do does not enhance their symptoms[7]. After this period of rest, return to sport should be conducted in a graduated manor starting with daily activities that don’t provoke symptoms, as shown in Table 5[7].

Table 5 – return to play guidelines. Table taken from McCrory et al.[7]

|  |  |  |  |
| --- | --- | --- | --- |
| **Stage**  | **Aim** | **Activity** | **Goal** |
| 1 | Symptom-limiting activity | Daily activities that do not provoke symptoms. | Gradual reintroduction of work/school activities. |
| 2 | Light aerobic exercise | Walking or stationary cycling at slow to medium pace. No resistance training. | Increase heart rate. |
| 3 | Sport-specific exercise | Running or skating drills. No head impact activities. | Add movement. |
| 4 | Non-contact training drills | Harder training drills, e.g. passing drills. May start progressive resistance training. | Exercise, coordination and increased thinking. |
| 5 | Full contact practice | Following medical clearance, participate in normal training activities. | Restore confidence and assess functional skills by coaching staff. |
| 6 | Return to sport | Normal game play. |  |

**appendix 3 – the ed-cat**

**Emergency Department Concussion Assessment Tool [ED-CAT]**

Step 1 – Patient details/Background

Name: DOB:

Address:

ID: Gender:

|  |  |
| --- | --- |
| Examiner: |  |

-----------------------------------------------------------------------------------------------------------------

|  |  |
| --- | --- |
| Date:  |  |
| Time: |  |
| Date of Injury: |  |
| Time of Injury: |  |
| Cause of injury:  |  |
| How many diagnosed concussions has the patient had in the past? |  |
| When was the most recent concussion? |  |
| How long was the recovery from most recent concussion? | days |
| Has the patient ever been hospitalised for a head injury? | Yes / No |
| Has the patient ever been diagnosed or treated for headache disorder or migraines? | Yes / No |
| Has the patient ever been diagnosed with learning disabilities/dyslexia? | Yes / No |
| Has the patient ever been diagnosed with attention deficit hyperactivity disorder? | Yes / No |
| Has the patient ever been diagnosed with depression, anxiety or sleep disorder? | Yes / No |
| Current medication: |  |

Step 2 – Orientation Step 3 – Immediate Memory

|  |  |  |
| --- | --- | --- |
| What month is it? | 0 | 1 |
| What is the date today? | 0 | 1 |
| What is the day of the week? | 0 | 1 |
| What year is it? | 0 | 1 |
| What time is it right now? (within an hour) | 0 | 1 |
| **Score** | **/5** |

|  |
| --- |
| Read out the list of words then get the patient to repeat them back to you after you’ve said all 5. Then repeat this two more times. Their score is the number of words they get right in any order. |
| Finger, Penny, Blanket, Lemon, Insect | /5 | /5 | /5 |
| **Score** | **/15** |

Step 4 – Symptom Screen

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | None | Mild | Moderate | Severe |
| Headache | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Pressure in head | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Neck pain | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Nausea or vomiting | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Dizziness | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Blurred vision | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Balance problems | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sensitivity to light | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sensitivity to noise | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|  | None | Mild | Moderate | Severe |
| Feeling slowed down | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Feeling like in a fog | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Don’t feel right | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Difficulty concentrating | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Difficulty remembering | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Fatigue or low energy | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Confusion  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Drowsiness  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| More emotional | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Irritability  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Nervous or anxious | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Trouble falling asleep | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Symptoms worse with physical activity | Yes/No/Unknown |
| Symptoms worse with mental activity | Yes/No/Unknown |
| **Total number of symptoms** | **/22** |
| **Symptoms severity score** | **/132** |

|  |
| --- |
| Stand with hands on hips and eyes closed for 10s (except for tandem gait). Their score is 10 minus the total number of errors. |
| Which foot was tested? (non-dominant) | Right/Left |
| Double leg stance | /10 |
| Single leg stance | /10 |
| Tandem stance (non-dominant foot at the back) | /10 |
| Tandem gait (eyes open) for 3m | /10 |
| **Total score** | **/40** |

|  |
| --- |
| See if the patient remembers the list of 5 words from earlier, in any order. |
| **Total number of words recalled accurately** | **/5** |

Step 5 – Balance Examination Step 6 – Delayed Recall

Step 7 – Decision

|  |  |  |
| --- | --- | --- |
| Step | Domain | Score |
| 2 | Orientation | /5 |
| 3 | Immediate memory | /15 |
| 4 | Symptom screen* Number
* Severity
 | /22/132 |
| 5 | Balance examination | /40 |
| 6 | Delayed recall | /5 |
| Diagnosis: | Inform patient to return to the ED within 2-4 weeks if symptoms don’t improve or get worse. |
| Plan/Follow up: |

**appendix 4 – model of improvement**

Model of improvement and plan, do, study, act cycle for this quality improvement project. Future initiatives and further repeats of the cycle are present in red. See Figure 2.

**appendix 5 – power calculations for each section of the ed-cat**

A power sample size calculation has been calculated based on data from this study. This was a two tailed calculation with alpha error probability was set at 0.05, and Power (1-beta) was set at 0.95. For each section on the ED-CAT, in order to be powered adequately, the ideal sample size shown in Table 6.

Table 6 – Power sample size calculation for each section of the ED-CAT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Orientation | Immediate memory | Number of symptoms | Symptom severity | Balance examination | Delayed recall |
| Reattenders t-test, mean (Sd) | 3.67 (1.155) | 10.67 (5.859) | 17.00 (4.000) | 69.33 (16.623) | 12.67 (21.939) | 2.33 (2.517) |
| Non-reattenders t-test, mean (Sd) | 4.73 (0.508) | 13.81 (1.391) | 10.65 (6.567) | 33.22 (27.215) | 25.11 (14.525) | 3.08 (1.656) |
| Effect size (Cohen’s d) | 1.188057 | 0.7374188 | 1.167888 | 1.60135 | 0.6686359 | 0.3520385 |
| **Total sample size** | **136** | **348** | **140** | **76** | **422** | **1514** |

Sd – standard deviation