

Investigating the Effect of Hit in Head during Basketball on teenagers' Short-Term Memory

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Abstract: Head injuries may cause traumatic brain injury (TBI) and chronic traumatic encephalopathy (CTE), leading to dysfunction in memory. In this research, I tested short-term memory within two groups of male students around the age of 17 and 18 to see whether there's difference for those who experienced hit to the head during basketball game. I sent out questionnaires and gave the subjects memory tests to collect data. I found that there is an obvious decrease in the student's test score after being hit in sport.

1. Introduction

It is known that traumatic brain injury (TBI) and chronic traumatic encephalopathy (CTE) are caused by repetitive head injuries or heavy hit to the head^[1]. TBI is caused by impact to the head that disrupts the normal function of the brain. TBI's symptoms may include headache, loss of consciousness, behavioral changes, cognitive impairments, and difficulty sleeping. CTE is a neurodegenerative disease that is partly caused by repetitive traumatic brain injuries, including hit to heads, and concussions. CTE's main symptoms include memory disturbances, behavioral and personality changes, parkinsonism, and speech impediment. Sports may involve head injuries like hit in heads and falling, which can cause light symptoms of TBI and CTE^[2].

This research is looking at how sports injuries in the head affect memory function in teenaged students. The research is done among two groups of teenaged students with the experiment group students who play sports like basketball, which gives students chances to experience head injuries; and control group students who don't play sports and don't experience head injuries. My hypothesis is that head injuries impair cognitive learnings with students in sport group scoring lower in memorial tests after experiencing head injuries^[3].

2. Results

2.1 Students Experienced Head Injury Do Show Symptom of Headache.

Table 1 Result of The Questionnaires

Student	Experiences hit to heads during sports?	Ranking of severity of injury	appearance of symptoms	of	Properly treated?
PW	No		No		
LXY	Yes.Hit by the ball.	1	Headache		No
DW	Yes.Hit by other student.	1	Headache		Yes

LZ	Yes,Hit by the ball.	1	Headache	Yes
CY	No		No	
XY	No		No	

Table 1 Shows the Result of the Questionnaires Given to the Sports Group Students.the Questionnaire Was Sent to the Students.the Students Were Asked to Self-Evaluate the Severity of Injury and Symptoms.

Among the six students in the sports group,three students experienced an impact to the head during the game.Two students were hit by the ball,while one student was hit by other student.All of the three students reported rank 1 of severity of injury,and symptom of headache after injury.Two students was properly treated after doing sport,and one student did not receive any treatment after being hurt.

2.2 Student Experienced Head Injury Do Show Decrease in Memory Test Scores.

Table 2 Test Score Data Recorded for the Research

Students	first day morning	first day evening	second day	seventh day	remarks
MTY	42.30	48.60	45.45	43.00	
HPH	33.60	35.30	35.50	31.30	
WSF	15.60	25.60	31.00	31.60	
SS	3.60	14.00	14.60	13.60	
JY	18.00	21.60	22.00	9.00	
Total average	22.62	29.02	29.71	25.7	

Table 3 Test Score Data Recorded for the Research

<i>Table 2 Student</i>	First day morning	First day evening	Second day	Seventh day	Remarks
PW	31	32.3	34.6	42	
LXY	29	23	27	29.3	
DW					student's data missing
LZ					student's data missing
CY					student's data missing
X					student's data missing
Total average	30	27.65	30.8	35.65	

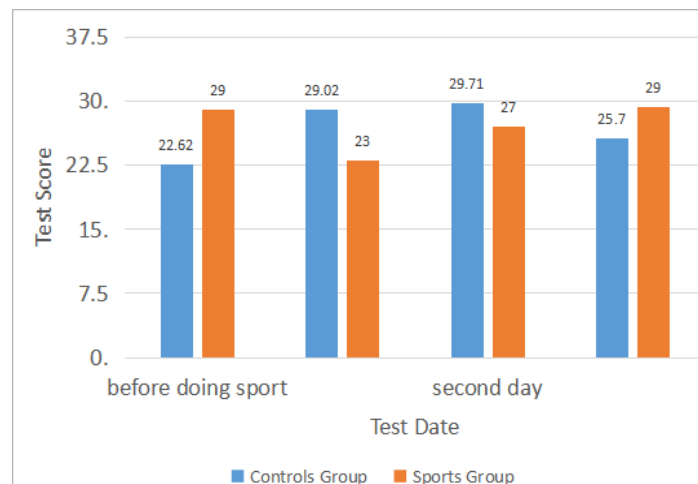


Fig.1 All Test Score Data Recorded for the Research

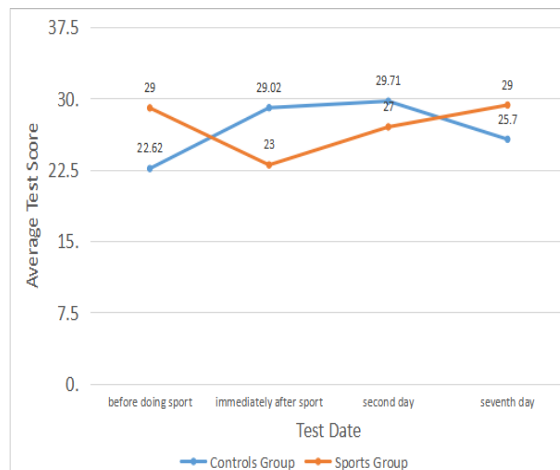


Fig.2 All Test Score Data Recorded for the Research

Table 2 Ble 2 And 3 Are All Test Score Data Recorded for the Research.

Figure 1 and 2 shows the average testing score of five students from controls group and student LXY's data from sports group. Here I excluded student PW's data because I want to see what has head injury done to student LXY's short-term memory.

As Figure 1 and 2 shows, average test score between controls group and sports group has great difference. Before doing sport, sports group's test score is higher than that of controls group's. Immediately after playing sport, which is after sports group was hit by the ball, the student's test score dropped and became lower than the controls group's test score. On the second day, which is 24 hours after sports group played basketball, his average test score rose, but was still lower than the average of controls group's average score. A week after he got injured in the head, sports group's test score went back to the same level as before the head injury, and became higher than the controls group's average score.

From the two figures, we can see that sports group's test score went through a decrease after hit by the ball during sports.

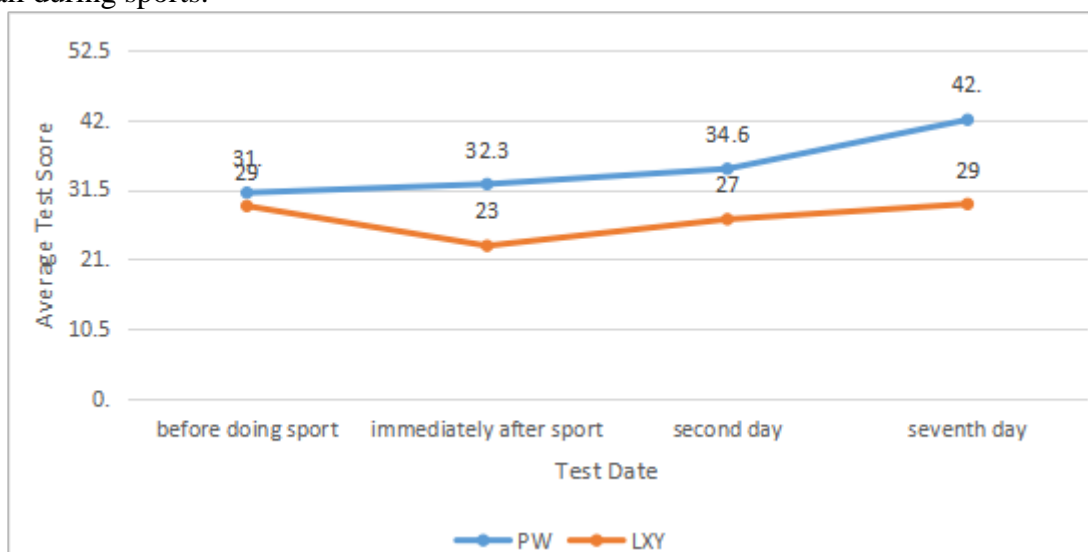


Fig.3 Compares the Test Score of Student Pw and Lxy, inside the Sports Group.

From the students' self-report, student PW did not experience any injury in the head during

sport, while Student LXY was hit by the ball during the process.

As the figure shows, Student PW's average test score does not show any decrease during the process of seven days, while student LXY's test score dropped after being hit during sport, and rose back after seven days. Both students were playing sports, but their test score trend went differently, with student LXY's average test score displaying a obvious reduce and student PW's remaining constant.

3. Methodology

3.1 Memory Test

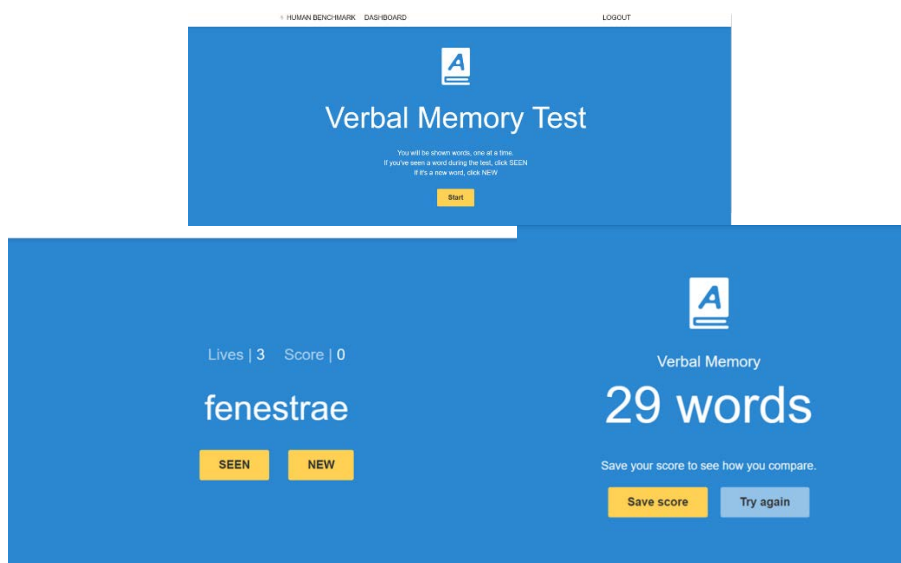


Fig.4 Screenshots from the Memory Test.

This research uses the verbal memory test Humanbenchmark.com, with a questionnaire for the sports group that includes questions like whether the participant has experienced hit in the head during sports or not. The verbal memory test will show the students a list of words one by one. The words will randomly repeat in the list, and students taking the test must choose whether a word shown is seen in the list before or new in the list. Students taking the test will have three chances of making mistakes.

3.2 Subjects

The research includes two groups of teenaged students, with at least 5 students in each group. The experimental group, which is the group of students who play sports and may go through hit in the heads, takes the memory test before they play sports, immediately after they play sports, 24 hours after they play sports, and 7 days after they play sports. In total, the sports group takes the test for 4 times, with each time repeating the test three times. The average score of the three tests will be calculated to keep the accuracy of the data. The controls group, which is the group of students who are not doing sports, with a low risk of experiencing head injuries, takes the tests the same time of the sports group, 4 times in total as well.

The basketball game that the sports group attended was in the afternoon of Aug. 11th. The game lasted for two hours, with a 15 minute break.

3.3 Questionnaire

- 1) Your Name?
- 2) Your Age?
- 3) Have You Been Injured Playing Sports? for Example Hit to the Head by Ball or Bumping into Each Other.
- 4) Have You Been Treated in an Emergency Room, or Hospitalized Following the Injury?
- 5) If You Have Been Injured, What is the Severity of Your Injury? Ranking from 1 to 10 (1 Being No Symptom, 6 Being Loss of Conscious, and with 10 Being No Recall of the Day after Injury).
- 6) Have You Shown Any of the Following Symptoms, Such as Headache, Dizziness, Tiredness, Problem Paying Attention, Loss of Memory, and Loss of Conscious.

3.4 Example of the Questionnaire Provided to Both Groups.

A questionnaire is also designed for the two groups. The questionnaire uses wjx program on WeChat, and is sent to every student participating in the research. The questionnaire is composed of 7 questions, with information about the student's name, age, whether he was hurt in the head during sport, whether he was properly treated after injury, the severity of injury, display of symptoms, and whether there has been injury that was not treated before the research. Both students from the controls group and the sports group received the questionnaire. The questionnaire is done when the students were doing the memory test for the second time, which is when the sports group students just finished their basketball game.

4. Discussion

The research result is mostly consistent with existing researches that after injury in the head, people's short-term memory level decreases. It is also true that the subject's memory level return to normal level 7 days after mild injury, which is also consistent with existing research results.

Due to a limit in availability of research subjects, this research is only done with 11 male students aged around 17 and 18. The conclusion of this research can only be adopted to male students around this age. As for female and students at other ages, further research is needed. The memory test chosen in the research only tests short-term memory within minutes. As for effect on teenager's long-term memory, other researches should be done.

In the research, due to the COVID-19, I was not able to meet the students every day, or record their status in person, thus I asked students to do self-report every time they do the memory test. This process led to problems in data collecting. Even though I reminded each student every time they were supposed to do report in memory test and questionnaire, there are still students that did not do their report on time.

In experimental group, Student DW, LZ, CY, and XY's memory test data are missing. Humanbenchmark, which is the memory test site, requires a login process. Due to this, Student LZ, CY, XY did not login while doing memory tests, so their test scores are not recorded in the website. Student DW did not sign up for the testing website, thus his test data are also not recorded in the website.

Also, due to the fact that the memory test was in English, which is not the students' first language, their test score may be influenced by their English levels or their ability to memorize vocabulary. More accurate memory tests is needed for further research.

For further research, more research subjects are necessary, and there should be a more concise way to determine each subjects' health condition. The subjects could also include teenagers aged from 12-18, both male and female, and sports other than basketball, such as soccer and football.

5. Conclusion

From the data recorded, there is a great difference between the controls group, the sports group, and between the student experienced head injury and those that have not. The decrease in student LXY's test score may be caused by the hit during the basketball game. However, due to the limited samples and data, the conclusion can not be certain. Further research is needed to discover the connection between teenagers' memory function and head injuries during sports.

References

- [1] Vakil, E., 2005. *The effect of moderate to severe traumatic brain injury (TBI) on different aspects of memory: a selective review. Journal of clinical and experimental neuropsychology*, vol. 27, pp. 8, pp. 977-1021.
- [2] Jordan, B. D., 2013. *The clinical spectrum of sport-related traumatic brain injury. Nature Reviews Neurology*, vol. 9, no. 4, pp. 222.
- [3] Pancar, Z., Özdal, M., Pancar, S. and Biçer, M., 2016. *Investigation of visual and auditory simple reaction time of 11-18 aged youth. European Journal of Physical Education and Sport Science*. Vol. 2, no. 4, pp. 145-152.