

Introduction

- ❖ Sports-related concussions (SRC) account for an estimated 3.8 million cases annually, with many individuals remaining undiagnosed and/or lack access to treatment.^[1]
- ❖ Young athletes in high-contact sports face a higher risk of mild traumatic brain injuries (mTBI) than those in low-contact sports.^[3]
- ❖ Previous studies have identified saccadic impairments in individuals with mTBI.^[2]
- ❖ A better understanding of SRC influences on saccadic eye-tracking parameters could guide more targeted strategies for injury prevention in concussion cases.
- ❖ Limited eye tracking research exists on the difference in saccadic parameters of both vertical and horizontal eye movements in mTBI studies.

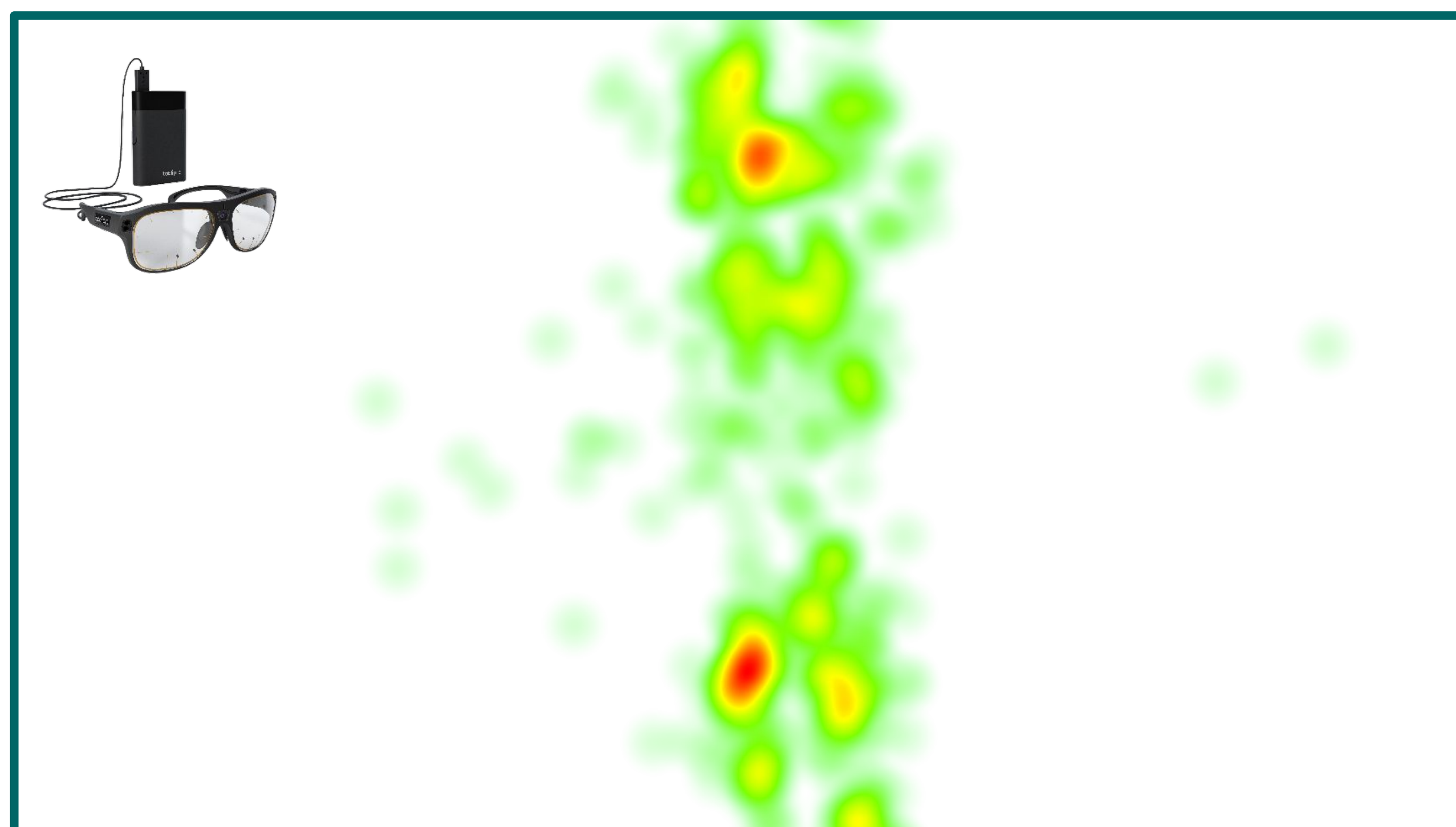


Figure 1. Heat Map of Vertical Eye Movements. Data was analyzed and captured using Tobii Pro Glasses 3 (shown on the top left).

Research Questions

Is there a difference in saccadic eye movement between high and low-contact sports?

- ❖ We expect a **reduced** number of saccades, **increased** saccadic velocity, **greater** saccadic amplitude, and **larger** pupil size in Ice Hockey (IH) athletes when compared to CrossFit (CF).

How does a history of concussion affect saccadic eye movements in Ice Hockey (IH) athletes?

- ❖ We expect a **reduced** number of saccades, **increased** saccadic velocity, **greater** saccadic amplitude, and **larger** pupil size in concussed athletes.

Methods

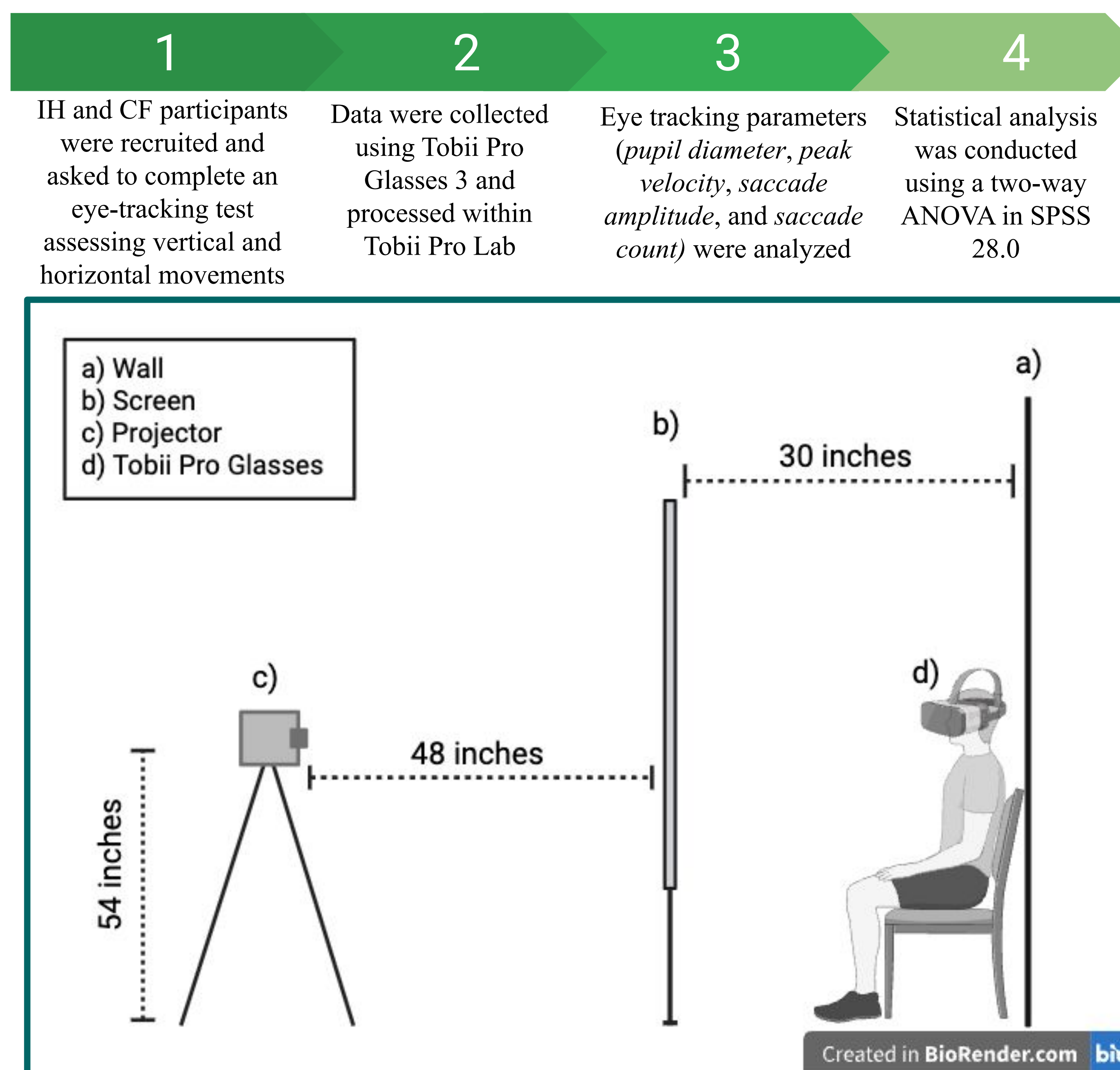


Figure 2. Experimental setup for this study. Layout features a 16:9 screen ratio, with a screen-to-wall distance of 30 inches, a screen-to-projector distance of 48 inches, and a projector height of 54 inches.

Results

Variables	Ice Hockey (n=22)	CrossFit (n=16)
Horizontal Tracking		
Pupil Diameter (mm) * †	4.85 (0.61)	5.73 (1.23)
Number of Saccades * †	13.7 (7.2)	7.0 (4.9)
Peak Saccadic Velocity (deg/sec)	439 (144)	374 (179)
Total Saccadic Amplitude (deg) * †	509 (378)	240(250)
Vertical Tracking		
Pupil Diameter (mm)	4.68 (0.54)	5.71 (1.29)
Number of Saccades	19.4 (6.6)	15.1 (5.0)
Peak Saccadic Velocity (deg/sec)	469 (122)	445 (70)
Total Saccadic Amplitude (deg)	621 (223)	466 (215)

Table 1. Athlete performance during horizontal and vertical eye-tracking tasks.

*Concussion history effect P<0.05; †Sport effect P<0.05.

Results

Variables	Non-Concussed (n=10)	Concussed (n=11)
Horizontal Tracking		
Pupil Diameter (mm) *	4.67 (0.47)	5.02 (0.68)
Number of Saccades *	16.2 (7.0)	11.6 (7.3)
Peak Saccadic Velocity (deg/sec)	451 (147)	430 (154)
Total Saccadic Amplitude (deg) *	583 (369)	458 (407)
Vertical Tracking		
Pupil Diameter (mm)	4.55 (0.40)	4.80 (0.64)
Number of Saccades	21.6 (6.6)	17.4 (6.1)
Peak Saccadic Velocity (deg/sec)	480 (134)	458 (116)
Total Saccadic Amplitude (deg)	656 (187)	586 (256)

Table 2. Effect of concussion history among hockey players on eye-tracking tasks.

*Concussion history effect P<0.05.

- ❖ **Participant demographics:** IH (Age = 25.1 ± 1.9 years; BMI = 25.8 ± 2.6 kg/m²), CF (Age = 25.3 ± 5.2; BMI = 26.6 ± 3.9).

Discussion

- ❖ A reduced number of saccades may reflect impaired saccade rate and a faster saccadic velocity would allow for more saccades to occur.
- ❖ Greater saccadic amplitude would suggest a longer duration of saccades.
- ❖ Statistical differences were observed in pupil diameter, number of saccades, and total saccadic amplitude during horizontal and vertical eye-tracking, regardless of sport or concussion history.
- ❖ This may suggest potential impairment in eye function in high-contact sport athletes.
- ❖ No significant differences were observed in eye-tracking parameters between athletes with a prior history of concussions and those without.
- ❖ Hockey players may be selected and trained for superior eye movement abilities, which could help explain group differences.

Future Work

- ❖ Investigate additional visual conditions, including nystagmus and the presence of multiple-step saccades.
- ❖ Continue to research the influence of saccadic parameters on smooth pursuit and extraocular eye movements.
- ❖ Future work will address sample size and technology limitations (e.g., controlling light level).

References

