Is there a need to rethink heading training in soccer?

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Soccer is a popular game enjoyed by over 250 million people across the world [1] played at elite as well as grass roots levels in community competitions. There has been a lot of interest in the soccer header and the possible adverse effects of heading the ball [2]. Worsey et al used the impact acceleration ratio of the Head to the Third Thoracic Vertebra (T3) using two synchronised inertial sensors and determined the impact ratio for elite players compared with novices [3]. This study forms part of a larger study to examine the relationship between head impacts and other physiological parameters. This pilot study examines the impact heading ratios for amateur high school soccer players of differing skill levels and field playing positions.

Twenty high school students (mean age 15.85±0.93 years) consented to participate in the study (Ethics Approval: 2017/896). The students played in different positions and all played at community club as well as school competitions. Two inertial sensors were placed on the students; one positioned over the occiput using an elasticised head band and the other placed over the T3 using an instrumented vest. The inertial sensor units were manufactured in-house (SABELSense, 250 Hz, ±16 g, 23 grams [3]). All the units were syncronised using an external pulse which was detected using Bluetooth.

The protocol consisted of the Thrower and the Subject directly facing each other at a distance of 3 metres. The Thrower threw the soccer ball 5 times for the Subject to head straight back without lifting their feet. All 20 participants completed the testing protocol. The ball used was a Size 5 Adidas Euro 2020 official match ball (Adidas Uniforia) which was inflated to 12 psi. The ball was thrown underarm to reduce the impact of the ball and to simulate a linear header.

The analysis of acceleration data consisted of removing the vertical component and then detrending the data. The maximum acceleration in the Head sensor with the corresponding acceleration in the T3 sensor was used to find the impact ratio Head/T3 for each impact. The Coefficient of Variation (CoV) and the median impact ratio was determined for each participant.

The soccer guidelines from the English FA [4] state that for U18's "heading drills should be reduced as far as possible, taking into consideration the heading

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exposure in matches". The participants in this study stated that they did not formally train heading techniques and typically performed their headers in the game. Figure 1 indicates that heading skill was not consistent for this cohort of players, which implies a range of head impacts with some possibly being of a higher magnitude. This lack of skill training and reinforcement might have led to a poorer skill uptake possibly leading to higher impacts due to the lack of consistency/technique. This scenario could then be translated to the game situation possibly leading to a higher risk for the participant. Figure 1a indicates that the different player field positions have different heading requirements. Figure 1b shows the velocity of the ball pre and post impact. The velocity was measured automatically in footage from a video camera using "Tracker" (https://physlets.org/tracker/), within an estimated uncertainty in the measurement of about 5%. It can be seen in Figure 1b that the throw is consistent and the resulting header is inconsistent. Since some of the headers are reaching the higher impact ranges there is a need to learn a safer and more consistent heading technique.
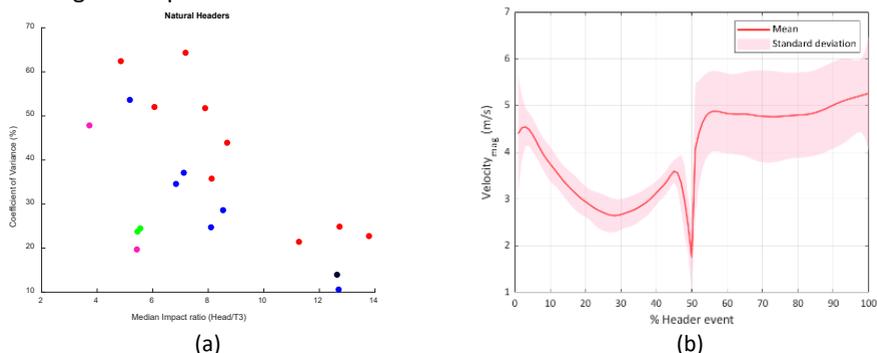

(a)   (b)

Fig. 1. (a) Variation in the median impact ratio for each partipicant. Blue – Defender, Red – Midfield, Green – Striker, Black – Winger, Pink – Goal Keeper. (b) Mean and standard deviation of the velocity of the ball due to the throw (<50%), at impact (50%), and after impact (>50%) for all headers.

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