RELATIONSHIP BETWEEN TACKLE FORM AND HEAD KINEMATICS IN YOUTH FOOTBALL

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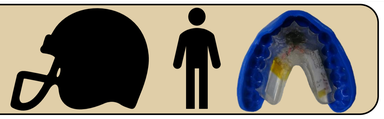
INTRODUCTION

- Youth football has over 2.8 million annual participants between the age of 6 and 13 each year.[1]
- Football has a high rate of subconcussive head acceleration events (HAE) due to tackling collisions which may lead to neurological deficits.[2]
- A tackle is a foundational skill of football and previous studies identified that use of proper tackling form influences head and neck injury risk.[3,4]
- **Study Objective**: Develop a tackling form grading rubric; evaluate the relationship between tackling form and head kinematics in youth football.

METHODS

Participants

- 14 male youth football athletes
  - Ages: 12-14 years old



A multi-step grading rubric was co-developed with football stakeholders. A grade of 0 indicates no attempt and 6 a successful attempt.

Four individuals with experience playing and/or coaching football independently reviewed events. An independent reviewer resolved differences.

Table 1: Tackle Form Grading Rubric

	Steps (Grade)	Sub.	Description (Max. of 2 Points per Sub Step)
1	Stance (0-6)	1.A	Tackler is in an athletic stance
		1.B	Feet are about shoulder width apart
		1.C	Tackler's head is up pointed towards ball carrier
2	Approach (0-6)	2.A	Tackler remains in athletic stance during approach
		2.B	Tackler is chopping feet during approach
		2.C	Tackler has a balanced posture/not falling/diving
3	Contact (0-6)	3.A	Tackler leads with inside shoulder
		3.B	Strikes the inside chest/hip with shoulder pads
		3.C	Tackler's head does not cross ball carrier's body
4	Head Placement (0-6)	4.A	Tackler makes contact with head up
		4.B	Tackler does not make first contact with head
		4.C	Head remains up for the duration of the tackle
5	Wrap Up (0-6)	5.A	Tackler wraps arm around ball carrier
		5.B	Tackler drives arms/legs upward
		5.C	Tackler squeezes ball carrier around hips/thighs
6	Follow Through (0-6)	6.A	Tackler chops feet and drives through tackle
		6.B	Tackler drives ball carrier to ground
		6.C	Tackler does not pull ball carrier backward

RESULTS & DISCUSSION

- 125 tackling events were reviewed using the tackle form grading rubric
- Of the 125 tackles, 86 (68.8%) were deemed successful
- A total of 149 head acceleration events (HAE) involving the tackler and/or ball carrier were reviewed using video verification and scored by football stakeholders
  - Median Linear Acceleration of 12.9 g
  - Median Rotational Velocity of 9.8 rad/s
  - Median Rotational Acceleration of 926 rad/s^2

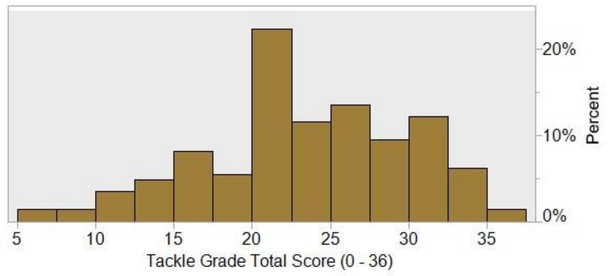


Figure 1: Distribution of Total Score for Tackle Form Grading Rubric (0 to 36)

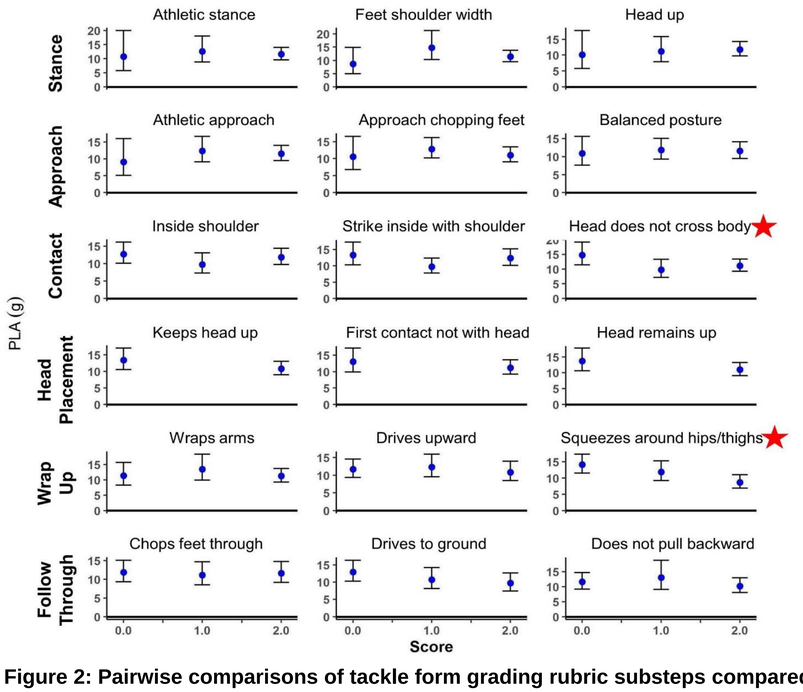


Figure 2: Pairwise comparisons of tackle form grading rubric substeps compared to PLA for tackles (n = 125) and HAEs (n = 149). Red starring indicates p < 0.05.

RESULTS & DISCUSSION

Table 2: Summary of LASSO regression model coefficients for tackles

	All Tackles (n = 125)			Successful Tackles (n = 86)		
Fixed Effects	**PLA**	**PRV**	**PRA**	**PLA**	**PRV**	**PRA**
Intercept	17.81	15.49	1181	17.1	10.5	1129
Athletic stance	-	-1.32	-	-	-	-
Head up	-	-0.81	-	-	-	-
Balanced posture	-	-	-	0.75	-	-
Head does not cross body	-1.14	-0.38	-	-	-	-
Keeps head up	-	-	-	-	-	-
First contact not with head	-0.52	-0.25	-	-	-	-
Head remains up	-	-	-	-1.58	-	-
Drives upwards	-	-0.06	-	-	-	-
Squeezes around hips/thighs	-0.77	-0.27	-	-1.56	-	-
Drives to ground	-	-	-	-0.34	-	-

CONCLUSIONS

- Better tackle form was associated with lower biomechanics on average.
- Tackles where tacklers lower their head, make first contact with their head, or allow their head to cross the body of the ball carrier lead to greater magnitude HAEs.
- Tackles were more often unsuccessful if the tackler failed to wrap their arms around the ball carrier during the wrap-up step of the tackle.
- This study includes several limitations including a low sample size of tackles from a single youth football team within a single organization.
- The results of this study can inform deficiencies in tackle form that may be targeted in future interventions such as training programs for coaches.

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