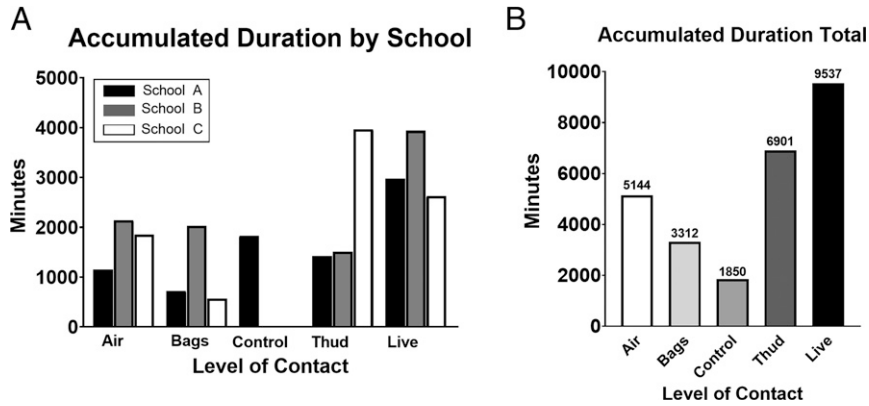


Supplemental Information



SUPPLEMENTAL FIGURE 6

Accumulated duration in each level of contact by school (A) and total (B). The number of minutes each school spent in each level of contact was used to control for the influence of duration within our primary objective.

SUPPLEMENTAL TABLE 2 Tukey's Post-Hoc Results on 5 Levels of Contact

	Air	Bags	Control	Thud	Live
Cumulative Impact					
Frequency/Player					
Air	—	—	—	—	—
Bags	-3.2 (-6.0 to -0.4) <i>P</i> = .015	—	—	—	—
Control	-9.6 (-17.6 to -1.6) <i>P</i> = .011	-6.4 (-13.1 to 0.4) <i>P</i> = .078	—	—	—
Thud	-23.6 (-33.2 to -14.1) <i>P</i> < .001	-20.41 (-29.0 to -11.8) <i>P</i> < .001	-14.1 (-21.1 to 7.0) <i>P</i> < .001	—	—
Live	-41.2 (-57.9 to -24.5) <i>P</i> < .001	-38.0 (-53.6 to -22.3) <i>P</i> < .001	-31.6 (-45.4 to -17.8) <i>P</i> < .001	-17.5 (-29.4 to -5.7) <i>P</i> < .001	—
Cumulative PLA/player, g					
Air	—	—	—	—	—
Bags	-53.4 (-102.1 to -4.8) <i>P</i> = .024	—	—	—	—
Control	-142.0 (-266.7 to -17.4) <i>P</i> = .017	-88.6 (-192.8 to -15.5) <i>P</i> = .132	—	—	—
Thud	-373.8 (-530.8 to -216.8) <i>P</i> < .001	-320.3 (-458.4 to -182.3) <i>P</i> < .001	-231.7 (-338.4 to -125.0) <i>P</i> < .001	—	—
Live	-698.3 (-993.9 to -402.7) <i>P</i> < .001	-644.9 (-922.3 to -367.5) <i>P</i> < .001	-556.2 (-803.6 to -308.9) <i>P</i> < .001	-324.5 (-532.0 to -117.0) <i>P</i> < .001	—
Cumulative PRA/player, kilorad/s²					
Air	—	—	—	—	—
Bags	-2.9 (-7.3 to 1.6) <i>P</i> = .385	—	—	—	—
Control	-8.8 (-18.5 to 0.8) <i>P</i> = .089	-6.0 (-61.6 to -23.3) <i>P</i> = .235	—	—	—
Thud	-24.2 (-35.7 to -12.6) <i>P</i> < .001	-21.3 (-31.1 to -11.5) <i>P</i> < .001	-15.3 (-22.7 to -8.0) <i>P</i> < .001	—	—
Live	-42.5 (-61.6 to -23.3) <i>P</i> < .001	-39.6 (-57.1 to -22.1) <i>P</i> < .001	-33.6 (-48.1 to -19.1) <i>P</i> < .001	-18.3 (-31.5 to -5.1) <i>P</i> = .002	—

Data are expressed as mean difference (95% CI for difference) and *P* values. —, indicates that posthoc results are listed in other side of the cells.

SUPPLEMENTAL TABLE 3 Tukey's Post-Hoc Results on 5 Levels of Contact After Controlling for Duration

	Air	Bags	Control	Thud	Live
Cumulative Impact					
Frequency/Player					
Air	—	—	—	—	—
Bags	-0.006 (-0.010 to -0.003) <i>P</i> < .001	—	—	—	—
Control	-0.005 (-0.009 to -0.0003) <i>P</i> = .028	-0.002 (-0.002 to 0.005) <i>P</i> = .691	—	—	—
Thud	-0.014 (-0.021 to -0.008) <i>P</i> < .001	-0.008 (-0.013 to -0.003) <i>P</i> < .001	-0.010 (-0.014 to -0.006) <i>P</i> < .001	—	—
Live	-0.011 (-0.016 to -0.006) <i>P</i> < .001	-0.005 (-0.009 to -0.0001) <i>P</i> = .046	-0.006 (-0.010 to -0.002) <i>P</i> < .001	0.004 (-0.0003 to -0.007) <i>P</i> = .097	—
ANOVA model results, F (2.54–185.70) = 24.21, <i>P</i> < .0001, $\eta^2 = 0.25$					
Cumulative PLA/player, g					
Air	—	—	—	—	—
Bags	-0.098 (-0.160 to -0.036) <i>P</i> < .001	—	—	—	—
Control	-0.067 (-0.134 to 0.0003) <i>P</i> = .051	-0.031 (-0.026 to 0.089) <i>P</i> = .553	—	—	—
Thud	-0.231 (-0.336 to -0.125) <i>P</i> < .001	-0.133 (-0.216 to -0.049) <i>P</i> < .001	-0.164 (-0.229 to -0.099) <i>P</i> < .001	—	—
Live	-0.187 (-0.280 to -0.094) <i>P</i> < .001	-0.089 (-0.175 to -0.003) <i>P</i> = .039	-0.120 (-0.190 to -0.050) <i>P</i> < .001	0.044 (-0.019 to 0.107) <i>P</i> = .306	—
ANOVA model results, F (2.46–179.40) = 22.88, <i>P</i> < .0001, $\eta^2 = 0.24$					
Cumulative PRA/player, kilorad/s²					
Air	—	—	—	—	—
Bags	-6.69 (-12.05 to -1.32) <i>P</i> = .007	—	—	—	—
Control	-3.67 (-9.08 to -1.74) <i>P</i> = .327	3.01 (-2.13 to 8.15) <i>P</i> = .477	—	—	—
Thud	-14.80 (-22.66 to -6.95) <i>P</i> < .001	-8.12 (-14.30 to -1.93) <i>P</i> = .004	-11.13 (-15.75 to -6.51) <i>P</i> < .001	—	—
Live	-10.47 (-16.83 to -4.11) <i>P</i> < .001	-3.78 (-9.72 to 2.15) <i>P</i> = .391	-6.80 (-10.86 to -2.73) <i>P</i> < .001	4.33 (-0.41 to 9.07) <i>P</i> = .090	—
ANOVA model result, F (2.72–198.6) = 16.24, <i>P</i> < .0001, $\eta^2 = 0.18$					

Data are expressed as mean difference (95% CI for difference) and *P* values. ANOVA, analysis of variance. —, indicates that posthoc results are listed in other side of the cells.

SUPPLEMENTAL TABLE 4 Cumulative Head-Impact Frequency and Magnitude for the Entire Season

	Overall	Lineman	Hybrid	Skill
Cumulative impact/player, count				
Air	2.00 (0.00–5.00)	3.00 (0.00–7.75)	2.00 (0.00–5.00)	1.00 (0.00–3.00)
Bags	4.00 (1.00–10.00)	5.00 (1.75–13.00)	5.00 (2.00–9.50)	3.00 (0.00–10.00)
Control	1.50 (0.00–14.75)	0.00 (0.00–22.75)	0.00 (0.00–18.00)	8.00 (0.00–13.00)
Thud	17.00 (5.00–42.25)	19.00 (6.50–58.75)	25.00 (8.00–46.50)	6.00 (2.00–20.00)
Live	19.00 (4.00–73.75)	14.00 (3.75–79.75)	49.00 (10.50–89.00)	13.00 (4.00–50.00)
Cumulative PLA/player, g				
Air	25.45 (0.00–66.95)	45.05 (0.00–105.93)	28.30 (0.00–76.60)	10.50 (0.00–35.90)
Bags	55.20 (17.38–164.50)	69.15 (21.50–178.80)	75.10 (21.25–181.50)	38.20 (0.00–161.10)
Control	21.10 (0.00–243.28)	0.00 (0.00–356.83)	0.00 (0.00–280.15)	115.90 (0.00–193.50)
Thud	231.95 (85.40–673.35)	282.50 (97.30–824.78)	371.20 (137.10–722.85)	115.00 (30.40–278.20)
Live	315.90 (64.20–1246.80)	216.65 (48.50–1266.20)	856.00 (168.90–1525.30)	236.30 (71.80–690.00)
Cumulative PRA/player, kilorad/s ²				
Air	2.28 (0.00–6.03)	3.45 (0.00–8.55)	2.40 (0.00–4.38)	0.74 (0.00–3.66)
Bags	3.74 (1.46–11.14)	3.52 (1.66–11.60)	5.83 (1.49–12.81)	2.27 (0.00–9.88)
Control	2.16 (0.00–16.32)	0.00 (0.00–25.63)	0.00 (0.00–16.76)	8.17 (0.00–12.89)
Thud	17.91 (4.94–41.49)	20.42 (4.31–55.74)	22.33 (8.82–45.14)	7.59 (3.48–21.83)
Live	16.36 (4.48–75.01)	12.92 (3.60–74.88)	63.59 (9.45–88.42)	10.30 (6.79–57.90)

Data are expressed as median (IQR).

SUPPLEMENTAL TABLE 5 Average Peak Linear Acceleration and Peak Rotation Acceleration

	Overall	Lineman	Hybrid	Skill
Average PLA/impact, g				
Air	12.30 (0.00–14.69)	12.65 (0.00–14.59)	13.66 (0.00–15.99)	10.50 (0.00–11.75)
Bags	14.53 (11.59–16.58)	14.77 (11.66–17.20)	14.48 (11.63–16.25)	13.31 (0.00–17.80)
Control	14.88 (13.54–15.95)	15.27 (13.35–15.81)	15.79 (13.23–17.20)	13.95 (13.50–15.89)
Thud	15.07 (13.88–16.81)	14.80 (13.63–15.93)	15.24 (14.43–17.53)	15.44 (13.25–16.96)
Live	16.22 (13.61–17.68)	14.96 (12.57–16.67)	16.77 (15.46–17.78)	15.00 (17.10–19.06)
Average PRA/impact, kilorad/s ²				
Air	0.92 (0.00–1.62)	1.01 (0.00–1.56)	0.86 (0.00–1.67)	0.74 (0.00–1.72)
Bags	0.95 (0.69–1.28)	0.93 (0.72–1.44)	0.97 (0.75–1.25)	1.10 (0.00–1.46)
Control	1.03 (0.79–1.37)	0.89 (0.78–1.24)	1.01 (0.78–1.24)	1.21 (0.63–1.48)
Thud	0.98 (0.81–1.30)	0.93 (0.79–1.06)	0.98 (0.84–1.24)	1.14 (0.81–1.82)
Live	1.03 (0.82–1.22)	1.00 (0.68–1.21)	0.96 (0.77–1.09)	1.21 (0.87–1.72)

Data are expressed as median (IQR).

SUPPLEMENTAL TABLE 6 Example Practice Plan in Relation to the Levels-of-Contact

				Date:	Tuesday
				Time:	3:30 PM
				Gear:	Full pads
3:20		Prepractice	By position		Air tempo
3:25	1	Warmup			
3:30			3:00 Cougar Jacks		
3:35	2	Live for 5	Third downs: 3/5; 3/9; 3/3; 3/7; 3/2		Live tempo
3:40			7 on 7: defensive script		
3:45	3	Group			Thud tempo
3:50			Inside run: offensive script		
3:55	4	H2O	Water break		
4:00	5	Special	Kickoff score		Air tempo
4:05		Teams	Coaches: grab and go		
4:10					Thud tempo
4:15	6	Team	No. 1 defense versus 2 huddles		Versus No. 1 offense versus No. 2 offense
4:20					
4:25					
4:30					Control tempo
4:35	7	Indy			
4:40			Get water during Indy		
4:45	8	Special	Punt return	Safe/return squad	Bags tempo
4:50		Teams	Coaches: grab and go		
4:55	9	H2O	Water break		
5:00					
5:05	10	Team	No. 1 offense versus 2 defenses		Thud tempo
5:10					
5:15					
5:20		Gather	Announcements		
5:25		Postpractice	Positions groups meet/stretch/breakdown		
5:30					

H2O, water.