Football Tackle Head Impact Analysis

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OVERVIEW

ETScience was contracted to assess the impact magnitude (linear acceleration) experienced by the head in a youth athlete performing Coach Bobby Hosea's Dip-N-Rip-Sticks Youth Tackle Progression System © (Dip-N-Rip-Sticks) compared to the standard (traditional) tackling technique, when tackling straight on and from an angle. In addition, we tested the comparative impacts of the Dip-N-Rip-Sticks tackling technique and the traditional tackling technique on a tackling dummy instrumented with accelerometers to determine linear acceleration (*g's*).

METHODS

Tackling Techniques

A 15-year-old boy was selected as the test subject. The subject had one year of traditional football experience, and had recently attended Train 'Em Up Academy for two 3-hour sessions to learn the Dip-N-Rip-Sticks tackling technique. The boy and his father provided written informed consent to participate prior to any testing being performed.

After several weeks of development and multiple pilot testing sessions, data collection took place on Saturday May 14,' 2011 at the Home Depot Center sports complex in Carson, California.

The subject performed several practice tackles using both the Dip-N-Rip-Sticks and traditional tackling technique. The Dip-N-Rip-Sticks tackling technique is purported to minimize the impact to the players head while tackling. This method was compared to a traditional tackle technique that involved keeping the head in a lowered position and to the side as the arms wrapped around a tackling dummy fixed to a sled. Although the head was in a lowered position, the subject did not make direct contact with his helmet and the tackle dummy such as would be seen with a "spearing" type of tackle. Both the subject and the tackling dummy were instrumented with accelerometers to determine the impact of the tackle technique on the head and the impact of the hit on the tackle dummy.

The subject was properly fitted with a Riddell-certified football helmet instrumented to record linear acceleration. He was then instructed to perform multiple trials tackling the dummy straight on and at roughly a 45-degree angle using both tackle techniques. In each trial, the subject ran about 10 feet before making contact with the tackle dummy. To prevent any bias, the subject was blinded to when the data was being collected during all trials. This was done to prevent the subject from performing differently if he thought he was being recorded.

Instrumentation

The inside of the helmet between the padding was instrumented with the Head Impact Telemetry System™ (HITS) technology (Simbex, Lebanon, NH) incorporated within the Sideline Response System ™ (Riddell Corp., Elyria, OH) to measure linear acceleration in *g* with 1*g* = 9.81 meters per second^2 providing peak linear acceleration of the objects center of gravity. HITS is composed of six spring-loaded single-axis accelerometers that were inserted into the helmet and powered by a concealed battery source that provides real-time impact data.

Furthermore, a separate triaxial accelerometer was attached to the outside back of the helmet and one to back of the tackling dummy. The accelerometer that was attached to the back of the tackling dummy allowed us to assess the magnitude of the impact of the subject's hit on the tackling dummy.

RESULTS

Comparison of the Dip-N-Rip-Sticks tackling technique to the traditional tackling technique.

Figure 1 below illustrates the percent difference of the helmet impact between the traditional tackle technique (**20.3*g***) and Coach Hosea's Dip-N-Rip-Sticks method (**11.6*g***) while performing a straight on tackle. The data was collected from multiple trails and averaged.

FIGURE 1

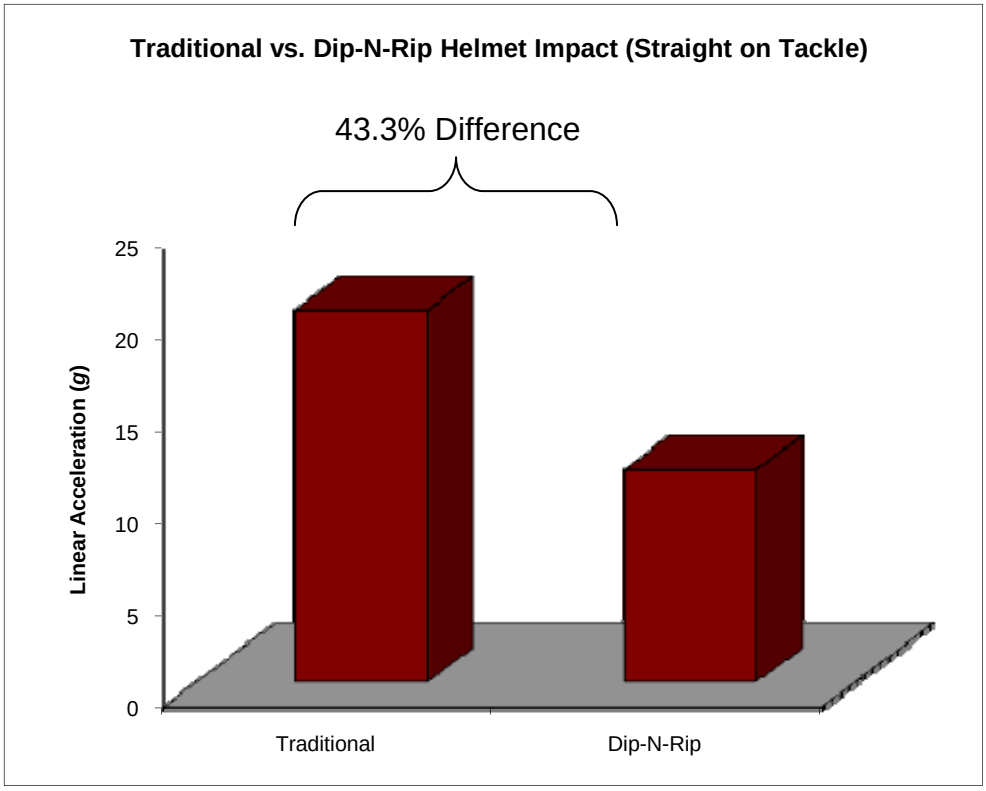
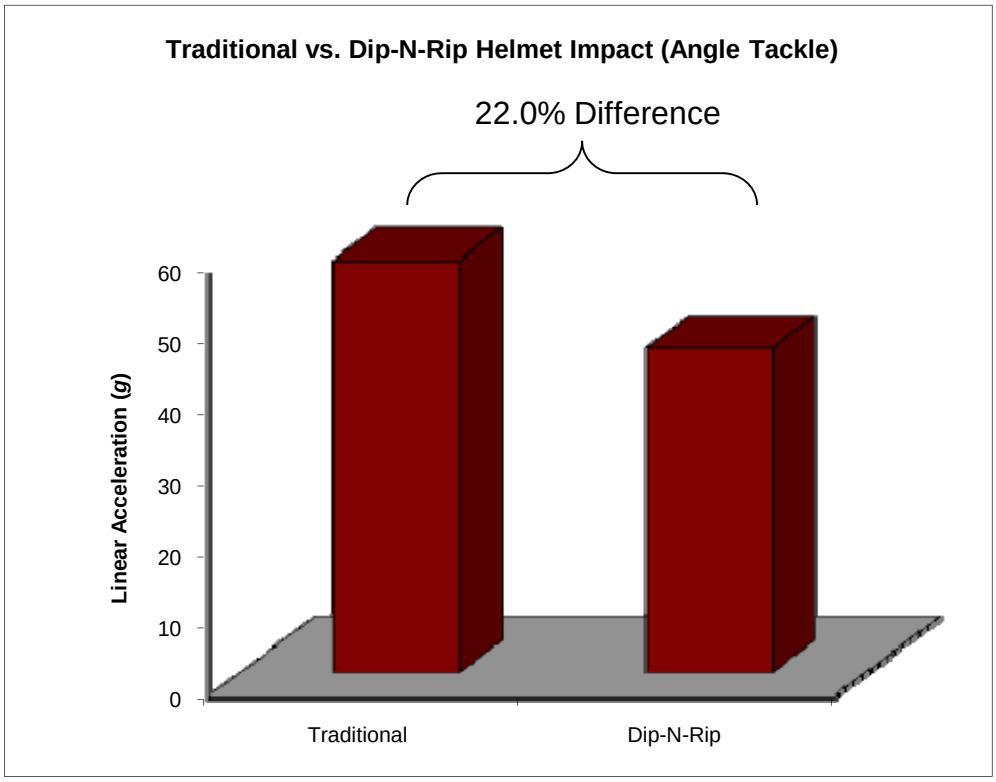


Figure 2 below illustrates the percent difference of the helmet impact between the traditional tackle technique (**58.4*g***) and the Dip-N-Rip-Sticks technique (**45.9*g***) while performing an angle tackle. The data was collected from multiple trails and averaged.

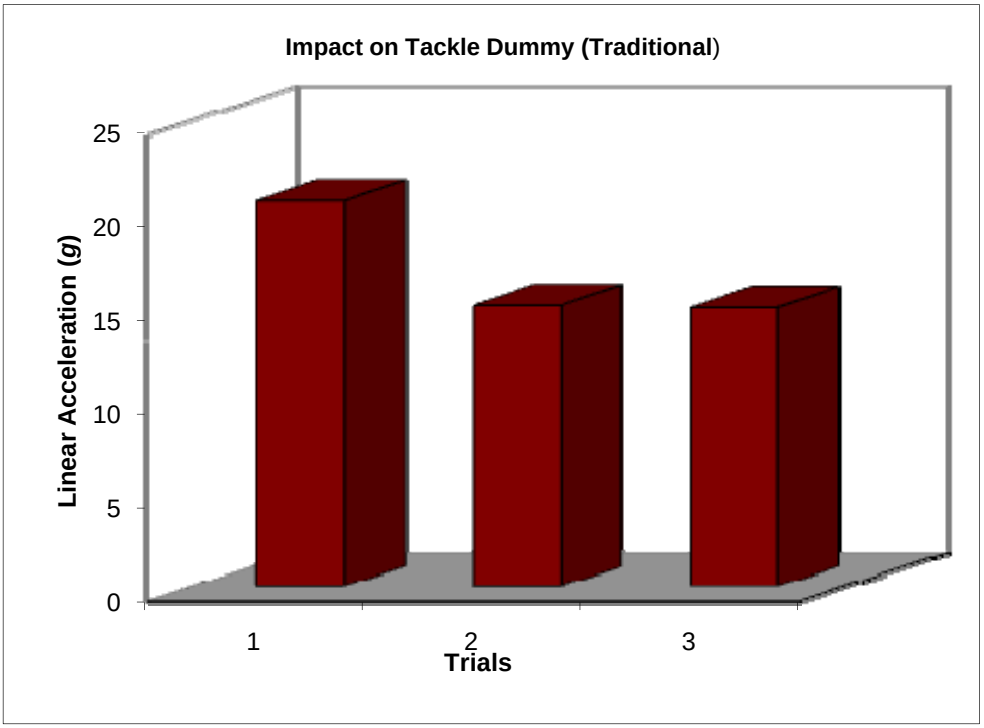
FIGURE 2



Impact Data on the Tackle Dummy

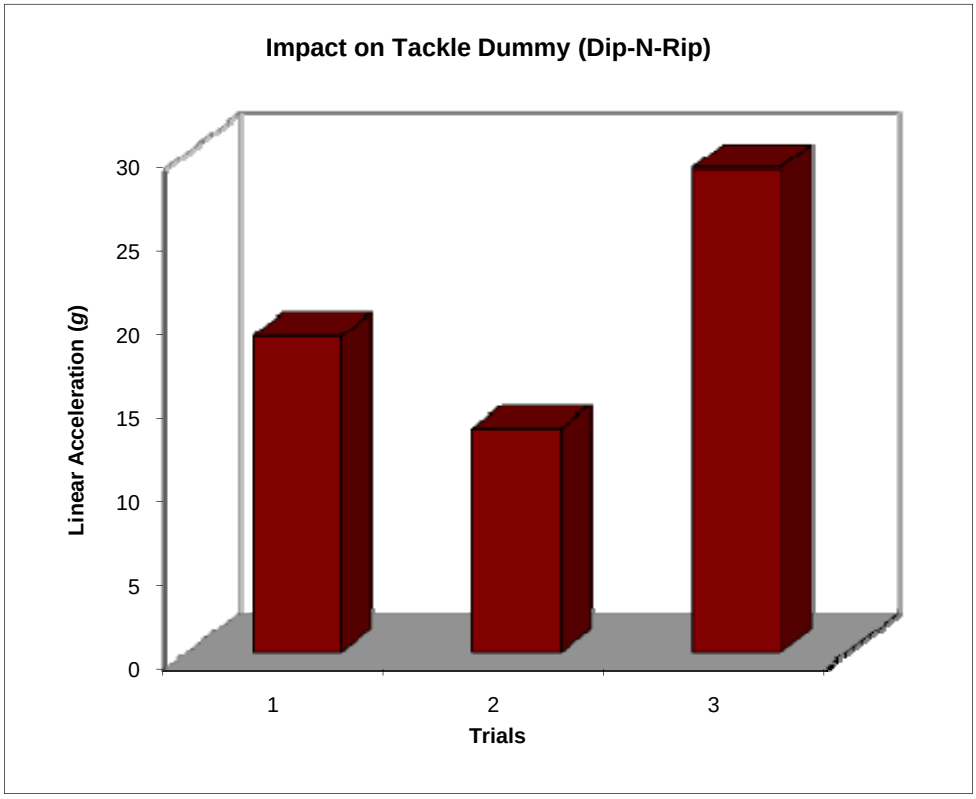
When the subject performed the traditional tackle technique the linear acceleration measured on the tackle dummy ranged between 15 and 20 *g's* (1*g* = 9.81 meters per second^2) with an average of **16.9 *g's***.

FIGURE 3



When the Dip-N-Rip-Sticks technique was performed, the linear acceleration measured on the tackle dummy ranged between 13 and 30 *g's* (1*g* = 9.81 meters per second^2) with an average of **20.5 *g's***.

FIGURE 4



CONCLUSIONS

Concussions and other mild traumatic brain injuries (mTBI's) commonly go unnoticed, hence sometimes called "invisible" injuries. Unfortunately many of these injuries do not show any signs or symptoms until 24 hours (or later) after the actual injury has occurred. Therefore, it has been proposed that the Dip-N-Rip-Sticks technique, by teaching athletes to minimize head impact, may result in a tackle that reduces the risk of mTBI's.

ETScience was contracted to assess the impact magnitude (linear acceleration) experienced by the head in a youth athlete performing the Dip-N-Rip-Sticks football tackling technique compared to a traditional tackling technique when tackling straight on and from an angle.

The Dip-N-Rip-Sticks tackling technique resulted in a **43%** lower impact on the helmet when performing an American football tackle (straight on) compared to the traditional tackling technique. Additionally, the Dip-N-Rip-Sticks tackling technique resulted in a **22%** lower impact on the helmet when performing an American football

tackle (angle hit) compared to the traditional tackling technique. The absolute magnitude of the angle tackle for both techniques was approximately 3-fold higher when compared to the "straight on" tackle technique. This is likely explained by a change in direction (angled cut) just before hitting the tackle dummy. Since accelerometers measure changes in acceleration (changes in direction) and the angled tackle is associated with an explosive change in direction compared to the "straight on" tackle technique, a consistent higher recording of *g's* was measured with the angle technique even though the relative impact on the tackle dummy was similar between the tackling techniques.

It was also important to assess the magnitude of impact on the object receiving the tackle (tackling dummy). The Dip-N-Rip-Sticks technique delivered a higher impact (**20.5*g***) on the tackling dummy when compared to the traditional technique (**16.9 *g***). These data suggest that even with a similar impact on the dummy between tackling techniques, the Dip-N-Rip-Sticks technique was delivering a slightly larger hit (Figures 3 and 4).

Overall this analysis has shown that Coach Bobby Hosea's Dip-N-Rip-Sticks Youth Tackle Progression System © results in a significant reduction in helmet impact by as much as **43%** when compared to the traditional tackling technique.