Casey Tucker

MCS 100

Abstract

Evolution of the Physicality in Football

Physics of Football: How much has the game of football changed since 1950? How much force would Ngata generate with a 10 yard get off? Determining the force of the hit measured by one of the most powerful and explosive players in the NFL is helpful in understanding the severity of impacts players are subjected to. Knowing this information helps companies like Riddell and Schutt develop new products that allow players to sustain these impacts with no serious head injuries. I will approach this problem by laying out the scenario and accurate data from each player who will stand 20 yards away from each other and get a running start of about 10 yards before contact is made. I will use the same approach used when a baseball players bat makes contact with a 90 mph fast ball.

For this experiment, I chose 3 of the best interior defensive linemen of their time, starting with Ernie Stautner in 1950, “Mean” Joe Green from 1970, and Haloti Ngata representing present day. I chose to select players from the interior defensive line because it exemplifies some of the most dramatic changes in player size, purpose, and strength. The defensive line really modeled the insane size change in players over the last 60 years. During Stautners time, there was no reason to be a 300 pounder because it was all about speed and technique, and there were no offensive linemen that could

really move him. He just needed to worry about stopping the runners forward progress; which isn't too hard when the runner is 170 pounds. In the 70's, the game was starting to get a little faster as the players grew in size. As time proceeded to advance, the size of the linemen changed in favor of larger linemen, and at some times, faster. Today, Haloti Ngata is one of the best interior defensive linemen in the NFL; he exemplifies the games requirement for a much larger human being to stop the run.

I decided I wanted to quantitatively find out how different the game has became at a physical level. I decided to run a little simulation to measure the amount of damage each player was capable of. It is set up so that each player has 10 yards to reach his maximum speed before facing a head on collision with a wall. I was able to run this simulation with the knowledge of Ngata's 10 yard split (1.73 seconds) and his mass, divided by the average NFL contact time in any collision (.2 seconds). I was able to repeat this formula (F=mv/.2) for the other two by educationally estimating their 10 yard splits. I was able to do this by looking at 10 yard split recordings from previous NFL combines and finding the average 10 yard splits from those who shared the same 40 time with Stautner and Greene. The results turned out how I expected with Ngata with the largest amount of momentum and impact force. Ngata's impact created an impact that measured up to 1,270 pounds of force which is comparable to the weight of a baby whale. Greenes impact measured 1.090 pounds of force which is equal to the weight of a bull shark, and Stautner created an impact that measured 893.5 pounds of force, which is about the weight of an average sized male polar bear.

After I collected enough data about each players momentum created at max speed, and their impact force; I decided to match each player in a head on collision. The match ups serve the purpose to help us get a sense of how powerful each player is, and what the end result is. The end result ended in favor of Ngata every time, obviously, but the results speak to answer the difference in the force of the players over time. When Greene and Stautner faced each other, Greene won the battle by sending Stautner back with a momentum of 79.28 kg m/s and an initial speed of 1.7 mph. When Ngata and Greene faced each other, Ngata won, but not by as much as Greene had beaten Stautner. After the collision took place between Ngata and Greene, Greene was sent back with a momentum of 71 kg m/s and an initial speed of 1.28 mph. For fun, I decided to see what would happen in a head on collision between Ngata and Stautner. As expected, Stautner was sent back with a significant momentum of 135.6 kg m/s, and an initial speed of 2.9 mph. Stautner was one of the best players of his time, so the last thing I want to do is disrespect a legend. But the numbers really illustrate how much the players have changed over the last 60 years.

One of the things I found interesting was that the difference in impact force made a greater jump from 1950 to 1970 than it did from 1970 to today. It makes me wonder hoe much further the human body can go, and will there be a day when we have 400 pounders that run 5 second 40's. Or are we close to our limit where the increase in the line of expansion reaches a horizontal asymptote.

When a body undergoes a collision created by a momentum of 1130 kg m/s the individual receiving the blow will feel it. These hits are literally bone breaking, but there aren't many bones broken due to the way the energy is dissipated throughout the body and equipment. Even though shoulder pads seem to serve a large purpose in protecting football players, they don't really do a whole lot. A good pair of shoulder pads that haven't been broken in can usually absorb up to 68 lbs of force from the impact. This resistance is caused by the memory foam in the pad resisting the initial blow by prolonging the time of contact. But the pads do not relieve any player from the momentum felt in a hit. There are no pads in the world that can really stop momentum, but momentum is what makes the game interesting. That is why we still see concussions today, even with some of the best protective helmet technology. There is nothing that can stop momentum, but helmet and shoulder pad companies are working on helmets with a structure that has the ability to dissipate direct blows to the head.

What can I take away from my project? When I look at the results, it appears that speed is more important wen creating an impact impact force. But weight can be more beneficial in my situation as an offensive lineman. If my weight is distributed properly and with leverage, I will not be pushed back. Knowing the importance of the technicality of football by looking at the physics of it, I feel like I will obtain a concrete understanding of how I need to position myself and train my body.