

Executive Analysis:

The National Football League has been under severe scrutiny for its handling of concussions since the early 2000s. The league has recently been accused of everything from negligence to the outright endangerment of players, with a conglomerate of 80 lawsuits pouring in as over 2,000 retired players voiced their personal objections to the league's botched concussion policies and procedures. Within the last few years, professional football has undergone some significant overhauls – the NFL has made 42 rule changes since 2002 (Scutti, 2016) – in an attempt to protect its players and heal this reputation through a trickle-down effect, yet the implementation of rules alone has proved to be nearly pointless in actual execution.

In an effort meant as much to deflect criticisms as to protect players, the NFL has also pledged \$100 million to concussion research and technology development (Scutti, 2016), with much of this money potentially going towards the testing of both ImPACT technology and Q Collar equipment. Both of these developments are outlined in this paper; two technological advances were chosen because they are in similar stages of production, are utilized for vastly different aspects of concussion treatment and prevention, and are likely to be of similar price points with regard to mass implementation.

The ImPACT technology, a computerized and updated version of current concussion analysis tests, is a near shoo-in for the league's implementation. This technology is a one-time expense that would pay for itself many times over throughout the course of its lifetime, as well as provide staff with additional information about a player's symptoms that was inaccessible using previous methods.

The Q Collar, on the other hand, is a completely revolutionary idea and symbol. A thin compression collar meant to increase the levels of blood in the brain, this device utilizes physiological manipulation to, effectively, stop concussions before they begin. To introduce such a piece of equipment as a mandatory article for game days would not only protect players without sacrificing the rough and tumble nature of professional football, but it would also send the message that the NFL is completely committed to the protection of its players at any monetary cost.

Background:

While the negative effects of concussions are generally accepted as truth in most circles of today's society, the athletic portion of American culture has been much slower in its reactions to concussion research. Some may be due to the fact that NFL players themselves don't completely agree that concussions are the main issue they face. Some of this is perfectly understandable; much of the sports market has been fully exploited by the explosiveness of business, and this business now looks to continued athletic successes, rather than expansions, in order to keep itself afloat. In a world where athletes are commodities, those who sponsor them are more and more likely to promote each player's individual ability in an attempt to make that athlete, and therefore the brand associated with them, a household name. In addition to this intentional promotion, the sheer availability of information about player statistics helps to feed the fan desire for more and more evidence that their favorite players are, in fact, worth the hype.

This nearly unlimited exposure to fans, analysts, and talk shows has no doubt increased the personal brand of many top athletes, but it has also had the opposite effect for those players who are believed to be playing below their peak ability. Fans have shown that they are willing to be bombarded with information about players and teams, meaning that any poor performances, bad behaviors, and injuries are shown multiple times in great detail, often all to the same effect. While any of these offenses are forgivable the first few times, “injury-prone” especially is an almost impossible label for players to shake. The best way for a player to escape the label of “injury-prone” is for the injury to be blatantly visible – a broken leg is better understood than a torn ACL, which in turn is better received than a possible concussion. This compartmentalization of players continues despite the increase in understanding about the seriousness of concussions; on average, nearly a week was added to the recovery time for all concussed players between 2013 and 2014 (Binney, 2015).

In 2002, Dr. Bennet Omalu began voicing his opinion about a new cranial disease that he believed had been exacerbated by extended exposure to American football. This disease, which he named Chronic Traumatic Encephalopathy (CTE) has since been confirmed as a progressive, degenerative disease set off by repeated head trauma (Scutti, 2016). However, the legitimacy of CTE was not unquestioned in its infancy; the NFL’s Mid-Traumatic Brain Injury Committee (MTBI) was markedly resistant to the idea of a disease caused by football, and remained vocal about its views throughout the 2000s. In recent years, the league has made extensive steps to try and overcome this initial reluctance by implementing rules and pledging money to fund research that will ideally help keep athletes healthy in the near future. Years ago, the “paper and pen” test became the standard for identifying concussions in all realms of the sport (Href et al, n.d.). This test’s popularity was largely due to its accessibility; nevertheless, though there are few materials needed to run a paper and pen test, the amount of time it takes to accurately run a full paper and pen test for an entire team is a cost that many found difficult to justify by business executives who questioned the premise of these exams. Additionally, this test’s diagnosing capability depends entirely on the comparison of post-concussive tests to the result of pre-concussive evaluations, a step in the process that eats up even more time for healthcare and coaching staff. This type of comparison is also impossible to carry out on the sideline of a game, leaving players and coaches at the mercy of self-evaluations and split-second decisions.

The research that the NFL is now attempting to fund is almost entirely under wraps, but there is little doubt that their money is being spent in part to overcome the difficulties presented by the paper and pen test. Football and medicine have both embraced computerization in many forms already, and the computerization of concussion diagnosis would be a logical step in their mutual desire to streamline the process. The newly developed Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) technology is one such option that would allow for not only sideline tests, but also constant updates of cognitive ability throughout the season. This computerized system has the potential to drastically shrink the amount of time now required for concussion tests, making it easier for teams to establish baseline results for their players. Additionally, the NFL is likely to be encouraging the development of equipment that could help to stop concussions at their source, rather than merely detect their presence. For many years, this research dealt almost exclusively with equipment updates; helmets are still constantly being reevaluated for their ability to protect not only the skulls, but the brains of their owners. As

equipment personnel have begun to realize that helmets are severely limited in their ability to protect the brain, a new buzz for diagnosis and internal concussion prevention has begun to grow. Two of the most prominent technological advances are the ImPACT evaluations, which are used to diagnose and monitor concussions after impact, and the Q Collar, used to prevent or diminish the effects of concussive blows.

These developments, as they attempt to gain credibility, create remarkable dialogue about the future of the NFL with regard to concussions – will players consent to the hefty amounts of screening that ImPACT testing requires, and would they be willing to add a collar to the already impressive amount of equipment that “full pads” entails? Would the league be able to make this a strict rule, or would the NFL be better served by allowing individual teams or players to decide for themselves?

Analysis:

The subject of concussions within the sphere of the NFL is particularly interesting because of the business aspect of professional sports. As briefly mentioned above, the issue of concussions is particularly contentious because the commodities that could be negatively affected are people, and the negative effects that could potentially come to them have the potential to harm these people for the rest of their lives. Regardless of the human aspect, however, the fact remains that concussions have the ability to seriously damage a team’s investment in a player and the NFL’s investment in that team. Some of the most seriously affected players tend to be quarterbacks – despite the media’s denouncement of the NFL’s current concussion treatments, quarterbacks have begun to receive an average of 1.6 weeks of recovery time due to severity, while other players average 1.2 weeks of recovery time (Binney, 2015).

The reasons for this are not completely understood. Quarterbacks do not experience the repetitive, though subconcussive head trauma that those who play on the offensive and defensive lines are subjected to, and quarterbacks in the NFL already enjoy a large degree of protection from physical impact. The exact reasoning behind this extended rest period could simply be an extension of this protection, or it could be due to the fact that many of the men tackling quarterbacks happen to be quite a bit larger than the player absorbing the blow.

Regardless, this is of particular interest to the business side of football because quarterbacks also tend to rank as some of the highest paid individuals on any given team. For the 2016 season, the NFL designated a salary cap of \$155.27 million per 53-man roster, with total cap actually ranging from the Oakland Raiders’ \$164,324,461 to the \$128,789,961 of the Cleveland Browns (NFL Cap Tracker, 2016). This limited flexibility is therefore felt by all teams regardless of cap space – while the average NFL player earns \$1.9 million a year, a starting quarterback’s salary can range from \$4 million to Drew Brees’ \$20 million per year (NFL’s Average Salary, 2016), meaning that a single player could be 13.3% – or even 15.4% – of a team’s total salary cap. As in any business, executives are going to be hesitant to pull any commodity that has cost them such a large percentage of their resources. From a purely economic perspective, it makes the most sense to get the most utility out of the most expensive

players, despite the effects of injury. Additionally, the NFL has a massive market cap for its revenue, yet that revenue itself is extremely small for the NFL’s size (Figures 1 and 2).

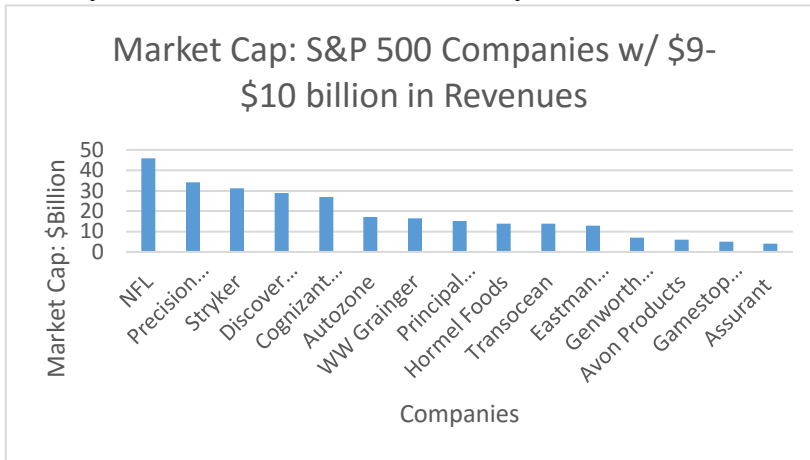


Figure 1: Market Cap of Comparable Companies (“If the NFL Were a Real Business, 2016)

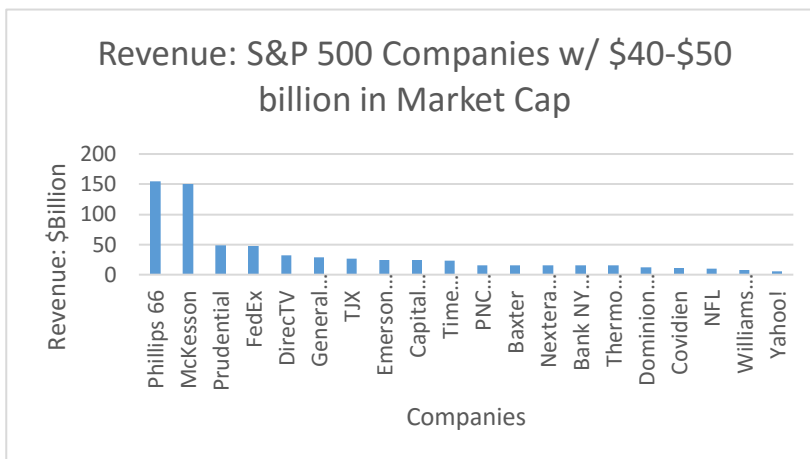


Figure 2: Revenue of Comparable Companies (“If the NFL Were a Real Business, 2016)

Though the thought may at first be contrary to what those numbers appear to display, the discrepancy between the market cap and actual revenue could be attributed to the impressive ability of the league to completely exploit every bit of its available market share. The NFL has carved out a significant part of the American economy – especially the part of the economy that is focused on sports – and its approximately \$46 billion market value, compared to its \$9.5 billion revenue, could be interpreted to mean that the value of the league is measured in something wholly unrelated to pure revenues (“If the NFL Were a Real Business, 2016).

The National Football League has made football an intrinsic part of American culture. A recent Harris poll indicates that the NFL was selected by sports fans as the American favorite, landing an incredible 35% of all of those surveyed (Rovell, 2014). Unfortunately for the NFL, this significant achievement leaves very little room for the league to continue growing. Managers, executives, and players educated about this business process are likely to be extremely cautious about any changes that could damage the league’s precarious positioning,

which is built largely on the reputation and accessibility that football currently holds in American society.

Significant changes always have the potential to make insurmountable waves, therefore all parties have the right to be cautious about changes to the way professional players are treated with regard to concussions, as this could have a serious impact with regard to how the NFL is perceived. Exciting games make money, after all, and the past has shown that big hits and general violence are some of the simplest ways to ensure an exciting game. As an example of how this mindset has permeated American culture, look no further than last season's January game between the Pittsburgh Steelers and the Cincinnati Bengals.

The movie *Concussion*, detailing the horrible effects of repeated concussions in football, had come out on Christmas of 2015, just a week and a half before this game. Yet despite the success and message of that movie, the brutal, violent, and overall exciting football game was still able to pull a higher overnight CBS ranking than the previous year's Wild Card matchup (Reimer, 2016), suggesting that while fans might be educated about the risks of the game, they might not actually care.

Much of the league's past resistance to research that connects concussions to lasting injury could be attributed to the executives' fear of taking on the significant sunk cost of removing a starting player from the game. As many casual fans may only know the names of these well-known starting players, there is also the danger of TV numbers dropping if these popular athletes are not featured in the main product. Clearly, these are the players that fans are willing to pay to watch play. In this same vein, both shot-callers and players alike could be expected to be hesitant of any major changes that could negatively affect either the numbers or ratings of NFL games.

Additionally, the current concussion testing procedures are not only monetarily expensive, but time consuming as well. This makes thorough and repetitive testing (as the tests were intended to be conducted) extremely costly for teams, making it more difficult for the league to instate overly strict regulations for testing without facing significant backlash.

Throughout this discussion, it has been assumed that health professionals, NFL executives, and NFL players themselves are all at odds with one another with regard to concussions and how to combat them. The arguments that have been made and well-publicized tend to pit doctors and businesspeople against each other, painting some as being overly cautious and others as overly flippant about the dangers of these largely unexplored injuries. This pattern, in fact, began as soon as the discussion started with Dr. Omalu's discoveries and subsequent dismissal by the NFL, and has continued in exactly the same vein ever since, despite all efforts to change the narrative. Yet despite this dramatization of the facts, many of the healthcare professionals working most closely with the athletes affected by NFL regulations are themselves employed by either the league or one of the league's teams ("Study: NFL Should End Team-Doctor Relationships," 2016).

The NFL itself has hired a full-time physician to be on its newly renovated concussion panel, and it is common practice for all professional teams to be affiliated with at least one

physician beyond their standard athletic trainer. However, a recently reported Harvard study has shown that this may not be the most desirable setup for the healthcare of the players themselves. According to the results of this two-year study led by Professor Glenn Cohen, players themselves are extremely likely to feel obligated to return to play much earlier than medically advisable when they are hurt during professional competition. This is to be expected. They have invested themselves well past the point of physical pain, day in and day out, and must also face a certain type of locker room machismo that expects its members to play with pain. In short, players often play past what medical professionals would consider healthy, at the risk of wreaking lasting or irreparable damage on their bodies.

The interesting part of the study, however, is that these feelings of obligation are likely to be intensified if their primary care physician is also connected to their professional team (“Study: NFL Should End Team-Doctor Relationships,” 2016). The implications of these results must be carefully unpacked for their full effect to take hold. The first implication of this study is that the doctors working with NFL teams have either been discussing matters of the players’ health with coaching staff or being pressured to return players to the field sooner than necessary by those same officials. The results of this action, whatever the primary motive, have the potential to seriously damage a player’s long-term health and ability to perform well on behalf of the team that wants him to play so badly. Another implication is that doctors and NFL businesspeople have been attempting to (rather haphazardly) convene and discuss the issues brought up by any given injury. The vast majority of healthcare professionals have little to no business education, and business executives are unilaterally unfamiliar with medical terminology and practice, and a shocking conflict of interest occurs when these two diverse groups are so carelessly mixed.

As previously mentioned, the nature of the NFL maintains that players must be thought of as commodities, and games as the most profitable product created by that business. The previously discussed Harvard study, while interesting and insightful, nevertheless continues that internal narrative by assuming that players are naturally obedient and responsive to the direction of coaches and physicians. While it is true that there is an immense cost to pulling an injured player out of a game, this cost is nothing compared to losing a player for an entire season because of an undiagnosed or repeated injury. This larger threat is largely up to the player as an individual, rather than as a commodity, and both the mentality and the culture of professional sports tend to prevent players from pulling themselves out of games due to injury.

Players are taught to shake off all the bumps and bruises from a young age, and toughness is often measured by the number of hits an athlete can take without complaining. It would be naïve to assume that the devastation caused by concussions is all the NFL’s fault, because much of it arguably comes down to the players themselves; competitiveness, the desire to prove oneself, and the ever-present need to earn a paycheck have combined to form a mindset that encourages players to stay in the game until they are physically unable to play any longer. Earlier this year, the current Steelers tight end Ladarius Green was reportedly experiencing headaches that could have had ties to a concussion sustained during an August game. Just a few days after this report came, out, Green publically denied ever experiencing these headaches to the press (Chao, 2016), which could be seen as an expression of the toughness and invincibility that so many players believe they need to achieve. This cost to both the players and their teams is made all the more difficult to swallow when the injury is not easily seen – it’s easier to pull out a

player with a broken leg than it is to pull a player with a possible concussion. Despite the league's apparent desire to instate rules designed to protect players, the sheer weight of this football culture adds additional difficulties to implementing stringent concussion protocols.

The problem with this ideology is succinctly explained by Rick Burkholder, the head athletic trainer for the Philadelphia Eagles, as such: "If you sprain an ankle, it comes back. If you hurt your brain, it doesn't come back." (Href et al, n.d.). The Eagles were among the first NFL teams to go above and beyond to implement concussion-prevention measures, and this simple statement is a clear rationalization of why. With this in mind, the effectiveness of player education as a combatant against future concussions begins to be questioned. The NFL's current concussion protocols, after all, have been disparaged and doubted no matter what their content, and the ability of outside sources to monitor the health of those in the game will be limited regardless of these rules.

Currently, the standard for NFL concussion evaluations is the general examination known as a "paper and pen" test. The paper and pen test includes a neurological exam – a measurement of vision, hearing, strength/sensation, balance/coordination, and reflexes (Concussion, n.d.) – as well as several brief tests of memory, motor skills, and concentration (Href et al, n.d.). These tests are conducted in depth at the beginning of the season for many sports, including football, and a condensed version of each examination is often conducted within 24 hours of direct head impact.

The results of these subsequent tests are then compared to the pre-season "baseline" examination, which is inherently seen as reflecting that athlete's normal functioning levels. This paper and pen test is both well-intentioned and relatively suitable for discovering the presence of concussions, yet the test remains far too expensive – for a single player, the necessary series of paper tests can cost up to \$2,000 per season (Href et al, n.d.) – and time-consuming for teams to conduct the large number of evaluations over the extended period of time that would be necessary to ensure that the player in question has, indeed, returned to his original cognitive levels. As the paper and pen test had to be administered in person, teams were either required to hire more staff that were trained to give the test, or to ask their existing staff to devote the necessary time to test all 53 members of their team. There also remains a rather unsettling amount of murkiness regarding the correct types of questions that an administrator should ask their potentially concussed player; the questions range from basic knowledge about the patient's life to long-term memory evaluations, and there was always the possibility that veteran players might have memorized the test bank of questions after so many years in the league (Href, et al, n.d.).

In order to combat these issues, Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) technology, a recent development, is slowly working its way into being adopted by the NFL. ImPACT assessments are meant to replace the standard paper and pen tests that the majority of teams still use to diagnose concussion severity; as of January 2016, only the Pittsburgh Steelers and the Philadelphia Eagles had the computerized ImPACT examination procedures in place (Href et al, n.d.). ImPACT is the result of a few developments in the environment of professional sports, including the computerization of data. These tests are able to overcome many of the shortcomings of the standard paper and pen assessments, and are hailed

for their ability to test the memory, rather than the general awareness, of the players being evaluated. The computerized nature of this new evaluating procedure allows for a larger question bank, fewer administrators, and far less time devoted to the simple act of overseeing concussion baseline testing.

Additionally, the ImPACT technology has advanced far enough to also be able to measure the time it takes any individual player to answer each question, giving healthcare personnel even more information about how a potentially concussive head impact could have affected the athlete. Much of ImPACT's success can be attributed to the participation of Merrill Hoge, who allowed researchers at the beginning of their investigation to administer the initial versions of concussion baseline tests on him before the 1994 season and after he sustained a career-ending hit (Href et al, n.d.). The shocking differences in his performance on these two successive tests was enough evidence for the researching team to continue working on their product, making it into the beneficial instrument it is today.

The NFL, possibly in response to the immense amount of negative backlash it has received regarding its reputation with concussions, has recently pledged \$100 million specifically for research into equipment and medical practices dealing with concussion prevention (Scutti, 2016). This giant sum of money is likely seen as a good investment in the NFL's future; concussion policies, lawsuits, and criticisms have proved costly for the league in recent years, and this commitment to research could be a tidy way to stem the outflow of cash to these parties.

One such development that the league could be funding research for, the Q collar, is also a way to stem some outflow, though the collar works not with cash, but with blood. This collar, like the ImPACT technology, is another piece of equipment that is beginning to make a name for itself in the field of concussion prevention. However, unlike the ImPACT technology, which is used for concussion diagnosis and documentation, the Q collar actually aims to prevent or lessen the effects of concussions in players, stopping the issue at the source (Taylor, 2016).

The collar's manufacturer claims that this is possible through the utilization of compression at each jugular vein on the sides of the neck (si.com), which slightly slows the outflow of blood from the head back to the heart. This slight increase in fluid volume in the brain is suggested to cause the brain to fit more snugly within the skull, meaning that the brain is less likely to be sloshed around the skull during concussive or subconcussive impacts (Taylor, 2016). Concussions are technically defined by the Centers for Disease Control and Prevention ("What is a Concussion?" n.d.) as, "a type of traumatic brain injury... caused by a bump, blow, or jolt to the head... This sudden movement can cause the brain to bounce around or twist in the skull, stretching and damaging the brain cells and creating chemical changes in the brain."

The subtle swelling of the brain that the Q collar causes is able to reduce the effects of blows to the head by preventing the brain from "bouncing around or twisting" within the skull during competition. While these collars and their theories are still being subjected to rigorous testing, the vast majority of results are remarkably positive and encouraging. In a study of youth players, the collars were able to prevent statistically significant changes in brain structure over

the course of a season that helmets alone could not (Taylor, 2016). The brain swelling has not been shown to have any negative effects on a player's cognitive ability during play.

One of the larger issues with this particular piece of equipment appears to be the compliance aspect – getting the athletes to wear the collar for the entirety of a practice or game. This could be due to the inconvenience of having an additional piece of gear to keep track of, the discomfort of wearing a collar (the collar's fit has yet to be evaluated by players, yet the comfort and wearability of this particular instrument is vital to the potential of it being used), or the possible lack of education given to players about the benefits of this device and how it works. While it may be only a few years before the Q collar is widely accepted as a way to lessen or prevent concussions, it is likely to be much longer before teams of any nature are willing to implement the collar as part of the uniform if players are unwilling to wear them.

Unlike the ImPACT technology, which has a definitive place in the NFL's potential future, the Q Collar is largely a wild card in the field of technological developments. There is no precedent for the Q Collar's implementation, unless comparison allows for the long reach back to the introduction of a helmet, so much of the league's action regarding the Q Collar has no expected timeline. This leaves the Q Collar in a bit of a quandary, as it stands to be one of the greatest breakthroughs in concussion prevention, yet faces significant hurdles as it waits to be either fully implemented or brushed aside – there is little middle ground for such technology, which is more likely to be either wholeheartedly embraced or entirely discarded by the league, with other football programs following the NFL's lead.

Conclusion:

With these new developments in place, and the current state of the NFL with regard to concussion responsiveness, it is extremely likely that the league will begin to mandate the implementation of at least one of these technological advancements within the next few years. It is interesting to observe that one of the most pressing motivations for employing additional measures to prevent or treat concussions comes not from medicine, but from media. Additionally, there have been no well-publicized stands taken by current players asking for an increase in concussion protection – the executives, long vilified for their inability to accept the horrific truth of CTE and concussions in general, now may face the difficulty of trying to fix the system they themselves have built.

To put it simply, there is no guarantee that individual teams, much less individual players, will be willing to spend the money and resources necessary to purchase one ImPACT systems and 53 Q Collars per team, for example, regardless of either the long-term benefits these technologies may offer or the requests of the NFL's highest officials. Nevertheless, it is vital for the future of the NFL that these technologies at least be given a chance in the regular season, and that their effects be carefully monitored and expanded upon as the league goes on. Concussions make up a surprisingly small percentage of the total injuries that a player can sustain while playing such a physical sport, yet their lasting effects and general unpredictability have made for a positive nightmare within the NFL's marketing department.

For an injury that ranks 10th in overall impairment for quarterbacks, linebackers, mobile players, and linemen alike (Binney, 2015), concussions have snagged the attention of the media, and because of its early dismissal of the issue, the NFL is working at a disadvantage with every breakthrough it makes to help. Though the league has carved out a significant niche market in American sports, this corporate giant will have to lumber through technological advances and reputation overhauls if it wants to be trusted as it was before 2002. It is certainly likely that the ImPACT technologies will be either force- or voluntarily implemented by all teams within the next few years; this technology will revolutionize, but not completely overhaul, any aspect of the NFL's current schematic. It is the Q Collar, and equipment developments of that nature, that truly beg the question of how the NFL really feels about concussion research.

The Q Collar is a disruptive technology in that there has never been a piece of equipment like it. This collar has been developed specifically to prevent and minimize the terrible effects of concussions in football players, and to implement these collars would be to commit, once and for all, to a game that cannot ignore brain injuries any longer. The machismo of football provides near certainty that any player who wears this collar voluntarily would be ridiculed or dismissed outright, therefore the league must decide to mandate their use in order to protect players for the future.

In an industry that has thrived on the concept of wins and losses, the NFL has indubitably been one of the biggest economic winners. Its huge cash flow, market value, and yearly revenue numbers are consistent and expected, due in no small part to its executives' savvy about both the market and the future. In this instance, however, those same executives are finding themselves in the wholly unique position of fighting both the present, future, and the past with regard to their oversight of concussion after-effects in the early 2000s. While it is highly unlikely that a lack of action to protect players from concussions will cause the NFL to immediately decline in popularity, it is much more likely that the constant backlash will slowly chip away at the league's solid market share until it dwindles behind the other professional leagues.

Within the next few years, the NFL will have the opportunity to make a solid claim on its current positioning in the American market with the implementation of revolutionary concussion-prevention measures. The league that has never lost is facing its toughest competitor yet in the decision of how to react to the ImPACT and Q Collar developments. In this instance, the decision to invest unswervingly in these new technologies is the only way that the NFL can continue to win not only the hearts, but the minds of its current players, as well as those to come.

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