

Evaluation of the Load Limiting Capabilities of Football Neck Collars using Anthropomorphic Test Devices

Steven Rowson¹, Stefan M. Duma¹

¹Virginia Tech-Wake Forest University, Center for Injury Biomechanics

ABSTRACT

The objective of this study was to perform a dynamic biomechanical analysis of neck collars in order to determine their effect on head and neck loading. A total of 48 tests were performed comparing the Cowboy Collar, Bullock Collar, and Kerr Collar. A control and each collar were tested at two speeds (5 m/s and 7 m/s), three impact locations (front, top, and side of the helmet), and two shoulder pad positions (normal and raised). A 50th percentile male Hybrid III dummy was equipped with a helmet, shoulder pads, and the various neck collars mentioned. The helmet was struck with a pneumatic linear impactor. With the top impact location, it was found that the Kerr Collar and Bullock Collar reduced head accelerations and force transmission through the neck. With the front impact location, all the collars reduced lower neck moment. The Kerr Collar also reduced the lower neck force and upper neck moment. With the side impact location, the Kerr Collar reduced lower neck moment. These reductions in loads correlate with the degree to which each collar restricted motion of the head and neck. By restricting the range of motion of the neck and redistributing load to the shoulders, neck loads can be effectively lowered. To investigate the differences in results that using a different dummy may present, the same methodology was used comparing the Hybrid III and THOR-NT 50th percentile male dummies. 24 matched tests with were performed with the Hybrid III and THOR-NT. Results from these tests indicate that the Hybrid III generates greater loads than the THOR-NT. The Hybrid III was also more sensitive to impact velocity. The dummies exhibited the same trends, in that either a load was reduced or increased; however, each load was affected to a different degree.