Full90Sports

Interpretation of chart - Full90 Product Testing: Neck data

The attached chart entitled Full90 Product Testing: Neck data is taken from DRI report 165-2-6, dated 23 June 2003. The testing consisted of dropping a Hybrid III adult male headform and neck in guided free-fall onto a second stationary Hybrid III adult male headform. The neck of the drop headform was instrumented with a series of accelerometers arranged to measure the forces and moments in the three dimensions X, Y, and Z.

Measurements of neck motions are similar, but not identical, to those for head impacts. The directional forces on the neck are analogous to the forces on the head, but accelerations of the head are more generally related to "moments" in the neck. Neck forces tend to push the head in such a way that it moves linearly forward, backward, sideways, or vertically. The neck moments, on the other hand, relate to tilt and twist of the head on the neck. A moment around any axis in excess of about 3400 Nm (Newton-meters) can potentially cause a serious neck injury.

On the chart, the top three impacts consisted of dropping a bare headform onto a bare headform. In the final five impacts the drop headform was wearing a Full90 Headguard; all other aspects of the impacts were identical. All of the neck moments in the "Full90" condition were essentially the same as the corresponding moments in the "bare" condition, indicating that the presence of Full90 on the drop headform made virtually no difference in what the neck felt. In addition, the highest neck moments occurred in the Mymin direction (backward tilting of the head), which is exactly what one would expect in this setup. None of the My moments, or any other moments reached even 1% of the injury level of 3400 Nm, so the risk of neck injury was almost non-existent.

The impacts were repeated using targets of hard rubber and steel post, with the same drop headform. Results were similar. In all of the measurements quantified in the full report, the highest observed moment was 42.90 Nm (1.26% of the injury level of 3400 Nm) in Mymax (front/back tilt of the head) of a bare headform striking the hard rubber pad. Even if one estimates that the threshold level for even minor neck injury might be as low as 300 Nm, the values reached in this experiment reached only about 1/7 of that level. These data make it clear that neck injury is very unlikely in the types of impacts that occur in soccer, and that the presence or absence of a Full90 Headguard makes almost no difference in the risk of neck injury.

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Full90 Product Testing: Neck data												
Data summarized from DRI report no. 165-2-6, dated 23 June 2003												
Test name	Fxmax (kN)	Fxmin (kN)	Fymax (kN)	Fymin (kN)	Fzmax (kN)	Fzmin (kN)	Mxmax (Nm)	Mxmin (Nm)	Mymax (Nm)	Mymin (Nm)	Mzmax (Nm)	Mzmin (Nm)
(Hybrid III forehead impacting Hybrid III forehead)												
Both headforms bare:												
frhcal04	0.19	-0.34	0.07	-0.04	0.58	-1.97	1.70	-1.57	4.61	-21.71	1.36	-0.39
frhcal05	0.13	-0.34	0.05	-0.05	0.59	-1.93	1.53	-1.86	2.95	-20.84	2.37	-0.63
frhcal06	0.15	-0.31	0.05	-0.06	0.60	-1.91	1.59	-1.85	2.93	-20.87	2.39	-0.81
Full90 Headguard on drop headform, target headform bare:												
frh11a13	0.11	-0.32	0.05	-0.04	0.57	-1.76	1.41	-2.72	2.01	-20.76	1.14	-0.74
frh11a14	0.10	-0.32	0.05	-0.04	0.57	-1.77	1.25	-2.68	2.60	-21.18	1.20	-0.82
frh11a15	0.11	-0.33	0.05	-0.04	0.59	-1.76	1.36	-2.60	2.36	-21.95	1.43	-0.78
frh11a16	0.10	-0.32	0.04	-0.05	0.56	-1.78	1.40	-2.64	2.67	-21.16	1.17	-0.78
frh11a17	0.10	-0.33	0.05	-0.04	0.59	-1.78	1.27	-2.76	2.75	-21.10	1.34	-0.72