"Coil Sports Safety Technology™"

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Abstract - Tate Technology, LLC ("Tate," or the "Company") is a sports safety technology licensing business, with two filed patents at the US Patent & Trademark Office, as well as the PCT, and is in process with third, fourth, and fifth patents. The first patent has six (6) separate patents within the patent, and the Company's first developed intellectual property is the "Coil Sports Safety Technology™," which will be marketed as "Advanced Concussion Technology™" which is applicable to all sports safety helmets, protective gear, military, construction, police, and riot helmets, as well as for skis, snowboards, and the automotive/racing industry. The Company's "Coil Sports Safety Technology™" is the culmination of R&D, development, and testing the coil technology fabricated in the least complex composition contained in Tate's patent. Tate will continue to develop and test more complex structures written in our patent.

Tate Technology, LLC initially tested the "Coil Sports Safety Technology™" at Virginia Polytechnic Institute, a NOCSAE-rated facility, using an off-shore manufacturer's finished product helmets fabricated 100% with carbon fiber. Tate then continued with multiple rounds of testing at Tate's testing laboratory in April, May, August, and September, and October 2014 using the Company's own internally calibrated NOCSAE Drop System. This paper summarizes results that indicate results in g-force, Gadd SI & HIC reduction.

History - The founder's grandfather is John Tate Riddell, founder of Riddell Helmets, and the founder's father, G.E. Morgan was the inventor and CEO of Riddell post WWII up to the sale to Wynn's Oil in 1976 – Wynn's owned Bell Helmets at that time. The founders grandfather and father both developed numerous (well over 60) patents including as examples: the removable screw-in cleat, and the basis for which Riddell was founded; the suspension helmet design that was licensed to the US Govt. for use in WWII helmets; all helmet technology designs pre-1976; joint venturing with Jack Welch, head of GE Plastics to utilize the best materials science when polycarbonate was developed by GE, as well as the "micro-fit" helmet, or sometimes called the "water helmet" (using air, pads, and fluid displacement). Additionally, design improvements were developed for shoulder pads, football, baseball and track shoes, plus the cleats, as well as for coaches' shoes. Riddell was originally a footwear company.

INTRODUCTION

The sports safety equipment industry recently entered into a significant transition period, reaching an echelon with current technology produced and made available in existing helmets and protective gear. The mounting numerous and mutually exclusive class-action law suits, regarding concussive issues, elevates the repercussions of the issue to the forefront across all sports disciplines today.

Presently, technology is advancing in the following: data/sensor systems to monitor impacts that manage end-to-end solutions tracking sports brain injuries for players; materials science using polycarbonate, ABS, Carbon Fiber ("CF"), and Kevlar – looking at new materials such as Graphene; liner systems using pads, air, fluids, and airbag systems on the exterior of the helmet itself. Some companies are also looking at helmet shapes to distribute the impact force further around the helmet, as well as double shells. Current helmet shell materials are selected for helmets based upon constant impact and the reaction to and mechanical properties of the materials paradigm, such as synthesis, structure, properties and performance. [1]

Where Tate's technology is advanced and forward-looking surrounds "attenuating" impact force at the point of "compression," which is what Tate's "Coil Sports Safety Technology™" is focused upon, and the Company's first patent addresses. As a note, the founder's grandfather created the first plastic shell, which was developed to prevent cracking the skull, and current use of polycarbonate and ABS materials effectively handle repeated impacts, but are not designed to attenuate.

The Company's goal is to address impact force at the point of "compression" versus "tension" where liner systems reside, and second addressing using particle physics coupled with material science from purely a molecular composition to achieve advancement in material science. Tate Technology, LLC is focused with its "Coil Sports Safety

[1] Wikipedia – Materials Science.

Technology™" on impact force at the point of "compression," or at the point of collision, "dissipating," and "energy attenuating" the impact force before the impact energy force progresses into "tension."

Alternatives - One company, UnEqual Technology, is using Kevlar, which the weave is an excellent light weight material, and it is offered to layer into current helmets. Another company in Europe, Swedish company Hövding, developed an airbag system to enclose the entire helmet in an impact, and a U.S.-based business, The Guardian, makes helmets with a padded exterior. Recently, companies are looking at double shells-VICIS, Inc.

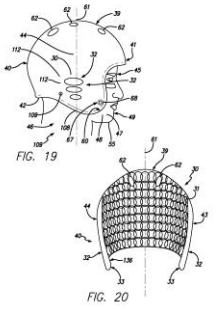
Materials Science - Historically, looking from past to present production, liner systems use variations of foam(s) that undergo a selection process based upon resiliency and absorption. Vinyl Nitrile foam is a versatile closed-cell, low-density construction with good outdoor durability - virtually indestructible, vinyl nitrile is used due to its properties to cushion, dampen vibrations and absorb shock.[2]

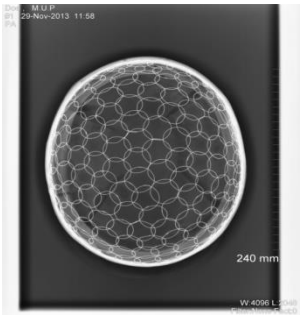
Polycarbonate materials, Lexan, developed by GE in 1953, is an excellent elastic thermoplastic containing carbonate groups (–O–(C=O)–O–), and most polycarbonates of commercial interest have a balance of temperature resistance, impact resistance, and optical properties, and polycarbonate can undergo large plastic deformations without cracking or breaking.[3] Helmet manufacturers also use ABS for similar qualities, and are incorporating or using carbon fiber, which is a reinforced composite materials science. In this case the composite consists of two parts: a matrix and a reinforcement. The reinforcement is carbon fiber, which provides the strength, and the matrix is usually a polymer resin, such as epoxy, to bind the reinforcements together.[4]

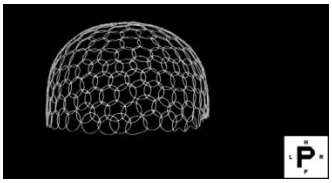
Carbon Fiber is intended to be a one-time hit material, which Tate Technology, LLC's "Coil Sports Safety Technology™" strengthens the carbon fiber to take on the material and chemical qualities more comparable for durability to polycarbonate and ABS for multiple impacts. Tate Technology shall address this further in a separate paper.

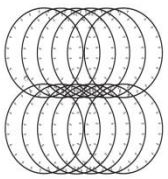
"COIL SPORTS SAFETY TECHNOLOGY™"

"Coil Sports Safety Technology™" encompasses impact attenuation through a multidimensional, structural "coil" "ring" system using enhanced impact recoil reflection and other control characteristics. The "coils," continuously linked as a contiguous unit, or as concentric rings, are designed to transfer and dissipate the small to significant impact energy waveforms through "waveform mediation." Each time the impact energy waveform makes a revolution through the "coils" the energy reduces and reflects, as indicated by the arrows "splashing" over into other coil channels, uniformly into all dimensions. *The coil process works in a "compression" manner versus a "tension" manner, and the mechanism primarily is "dissipation" then "attenuation" of the energy waveform.*

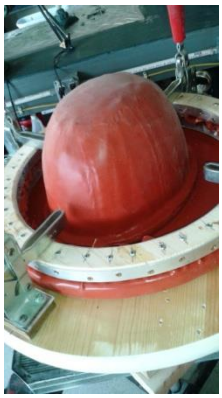








PROCESS OF MANUFACTURE



[2] www.clarkfoam.net

[3] Wikipedia: https://en.wikipedia.org/wiki/polycarbonates

[4] Wikipedia: https://en.wikipedia.org/wiki/Carbon-fiber-reinforced polymer

Carbon fiber layers are pre-cut in trapezoid shapes and numbered with an oval for the crown. Two layers of CF are layered on the aluminum head form using resin, followed by the prefabricated "Coil" system, then one additional, or third layer of CF, and then is placed into Tate's vacuum pump to mechanically embed the "Coil System" into the carbon fiber. Final three layers of carbon fiber are placed on top and once again vacuumed and sealed down to complete the helmet fabrication process. This process is accurately measured for the amount of resin to be consistent, and to eliminate air pockets in the layers, so all layers including the "Coil Sports Safety Technology™" is fully embedded, or mechanically correlated, as one unit helmet shell. Production is in a ambient temperature controlled climate environment at sea level, and the vacuum pulls 30" (inches) of mercury at sea level.

PROOF OF EFFICACY TESTING

Tate first tested at Virginia Polytechnic Institute, Center for Injury Biomechanics, Virginia Tech-Wake Forest University with Dr. Stefan F. Duma and his team of PhD's last November, 2013. Tate purposefully used flawed prefabricated (finished product) helmets with numerous production variables from an off-shore manufacturer. These helmets had an inestimable number of air pockets, were extremely inconsistent in fabrication process, i.e. number of carbon fiber layers, weight, density, and size. No specs and measurements were made available from the factory, and is an open question regarding tracking of their production process. We were supplied these finished product helmets that are being used in the market currently. Testing was proof of efficacy, and Tate achieved 11% reduction in g-force, SI & HIC testing with the NOCSAE Drop System, and from the Linear Impactor Tate achieved a reduction in Peak Rotational Acceleration from 3-18%, as well as in Peak Rotational Velocity from 3.5-7%. This is very promising data. Tate also ran CT scans and x-rays to demonstrate the vast number of flaws in these produced helmets, and to determine any breakage in the "Coil Sports Safety Technology™" itself, which was absolutely minimal, or <3%. The process was intentional to determine performance with the worst variables.

TATE TECHNOLOGY, LLC's NOCSAE DROP TEST

CONTINUED TESTING & RESULTS

Tate built its own completed testing facility/laboratory, as well as internal fabrication capability located in Salt Lake City, UT and Tampa, FL respectively. The testing facility has a NOCSAE Drop Test System with parts purchased from Southern Impact Research Center, and software from National Instruments using LabView data capture, DAQ and DiaDem for the program analytics. Additional lines of code and algorithms were written by one of the authors, Dr. G. Eric Morgan who also ran a software company creating and writing its code. This software is robust and what is currently utilized by the big three UA automotive companies, as well as Wayne State University. The helmet fabrication facility operated by Ronald L. Voller, who fabricated the helmets and liners for Riddell for well over 40 years, and the liners for Schutt for ~30 years, is also equipped to fabricate in-house lay-up carbon fiber helmets.

Since April Tate completed five test rounds in April, May, August, September, and October testing the simplest coil design, with different material gauges and coil sizes, as written in our patent. As a result, Tate determined in continued testing and R&D that the 1" coil using 24 gauge steel wire with ~25% overlap of coils on a consistent basis produced the results articulated in the Meta Analysis below. Additionally, the ¾" coils with same gauge steel and overlap produced better results on the crown, or top. Production process has continued to improve with consistency since May in the fully documented process. The vacuum pump is a GAST brand. Tank size: 10 gallon. Model no. 2567-P132 and pulls 30" of mercury at sea level, which is the altitude of the fabrication facility in Tampa, FL.

Tate produced both control and experiment helmets containing the coil system testing different coil sizes, overlap, and steel gauge from 24 down to 20 gauge using the simplest single-layer configuration in each of the past four of the five rounds of testing achieving the best results using the one inch (1") coil, 24 gauge steel, and ~25% overlap of the coil with important results. The results from two separate rounds indicate use of 1 inch coils with 24 gauge steel and ~25% overlap as a dominant and consistent structure and design. Additionally, the strategically placed use of ¾ inch coils using the same gauge steel and overlap added value in key locations on the helmet. The tests follow this basic protocol: Tate used 2 to 5 "protected/experiment" and 2 to 3 "control, or unprotected" helmets for each round using a lock-step logical approach to testing coil size, weight, structure depth, etc. determining best parameters.

Tate determined thus far in its continued R&D, and testing process that the 1" Coils, 24 gauge steel, approx. 25% Coil overlap, using 4, 5 & 6 layers of carbon fiber to be the most effective in our process.

Tate went past standard protocol on the number of hits per location on the helmet, and treated the carbon fiber as multiple impact materials science, such as polycarbonate or ABS in use today. Tate performed five to ten rapid successive impacts *(ten hits were used in the data below)* per location within the NOCSAE timeline allowance of 75 seconds ±15 seconds, and within the timeframe allotted moving the helmet from the monitored "conditioning environment," versus one per standard protocol, and tested four places on the helmets following NOCSAE standard protocol, which are: front, rear/back, right side & top, or 80 total hits per helmet for 2' ft. and 5 ft. drops respectively. The results noted below are derived from two "Experimental" helmets and two "Control" helmets. The Experimental helmets containing the 1 inch, 24 gauge, ~25% overlap one layer of coils demonstrated that there was reduction in: g-force – up to 21%; Severity Index ("SI") –up to 30%, and Head Injury Criterion ("HIC") – up to 27%. *Please refer below, and to the following pages for the results.*

Tate also determined that use of the ¾ inch coils in key locations supplemented the consistency. Tate continues to test additional designs contained within the Company's patent.

ANALYSIS FROM 1" COIL USING 24 GAUGE & 25% OVERLAP TEST

Control = carbon fiber only.
Experiment = has Coil System in the helmet shell.

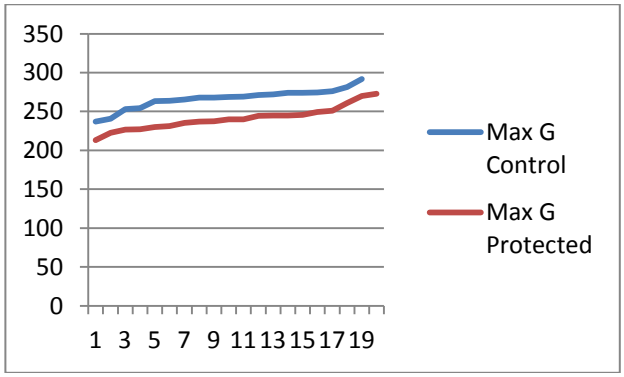
Control vs. Experiment follows:

Table 1. 24 Inch FRONT

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
83.74851	243.1029	211.69	80.18383	212.9559	187.6932
102.5503	310.7217	262.8712	84.68707	257.041	228.161
103.6674	316.4952	269.5046	90.65209	276.3802	241.5121
106.4297	357.4915	303.7013	93.06651	304.0215	264.7198
107.2335	361.778	309.1329	101.7178	323.218	267.4775
110.6578	362.1192	309.5111	102.5763	323.9535	268.544
110.8051	362.3436	310.4317	103.3352	327.3284	268.9562
110.833	366.4657	315.6828	104.1314	331.1466	281.0089
112.0375	371.1262	316.1921	105.182	339.5314	283.8064
112.6459	380.8538	325.823	105.5612	343.2902	285.8217
120.5551	427.2057	342.4199	106.0711	350.9629	289.6245
123.0584	454.501	373.7538	106.1043	350.9716	291.6771
123.8066	461.0242	379.8787	106.1066	351.1278	294.2004
125.992	462.1933	383.5397	107.3426	351.1653	297.9777
126.7158	472.0955	392.1443	108.2519	355.0026	298.2158
138.6097	520.3868	426.4405	109.3057	356.1806	299.349
140.823	543.3314	448.1812	110.2622	356.8948	300.3535
143.337	558.0263	461.3968	111.0374	357.8659	301.0687
144.4343	561.5997	463.5428	111.9366	360.5957	304.2033
145.1903	566.4719	468.677	112.2683	361.2642	305.9304

AVERAGE	266.6682	2380.775	2129.005	241.2326	2089.708	1854.164
STD DEV	12.74308	149.2831	148.7974	14.60354	186.5448	186.5686

	Analysis		
	Max G	GSI	HIC
% Change	13.93%	22.09%	21.40%



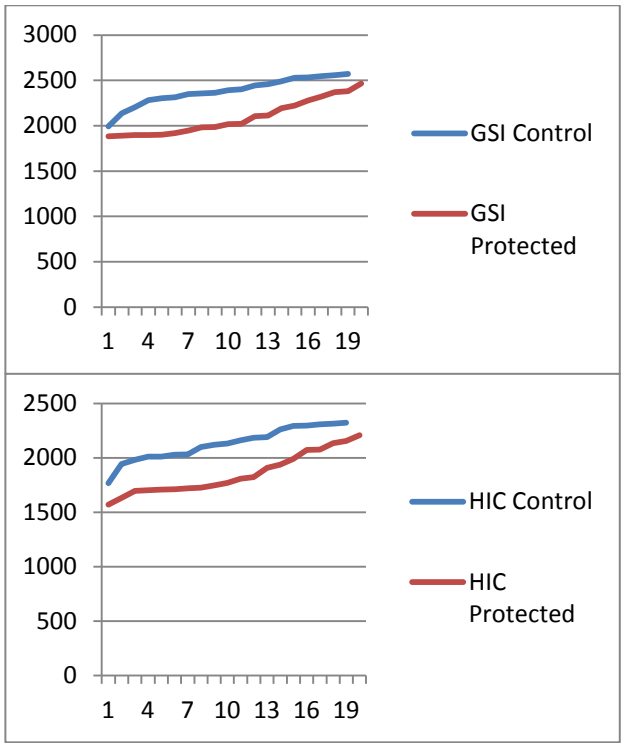


Table 2. 24 Inch REAR

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
80.8101	196.9484	166.2901	63.28451	120.0186	103.3671
90.02776	252.1086	215.3472	69.8374	163.8101	144.8295
91.07076	256.3774	221.0212	70.04203	183.5318	161.2836
91.8871	263.7716	223.3845	74.19224	190.1805	165.0815
95.11843	269.7668	223.7631	75.4953	197.6803	170.1272
95.21016	271.0118	233.291	77.92995	200.5733	173.1535
95.52673	274.6584	233.9618	78.78433	201.3232	173.7992
96.63479	280.2135	234.4691	79.21608	202.5745	175.2632
98.30502	287.8393	240.3433	79.33504	208.8566	180.1776
99.23928	288.6847	241.2736	79.78137	209.1355	180.4436
99.27646	289.444	241.7998	79.98482	211.053	182.7057
99.27755	290.0876	241.8665	80.20795	211.0714	182.9898
101.2795	307.599	262.7355	80.4358	212.7971	185.7125
101.6315	318.3151	263.1101	80.54912	213.0034	186.1012
101.9144	322.519	263.3626	80.82866	213.9535	188.713
102.3625	323.4711	271.7186	80.85168	217.4073	189.6009
102.4955	324.5452	271.8456	81.14993	224.8674	196.8815
103.7186	325.1476	272.0721	81.82051	229.0964	200.4268
104.5766	327.4398	274.7151	81.93227	230.4849	204.1522
104.7655	335.4453	275.9831	83.35798	244.8004	216.0386

AVERAGE	97.75642	290.2697	243.6177	77.95085	204.311	178.0424
STD DEV	5.798431	33.31974	26.40561	4.900765	25.8412	23.07576

	Analysis		
	Max G	GSI	HIC
% Change	20.26%	29.61%	26.92%

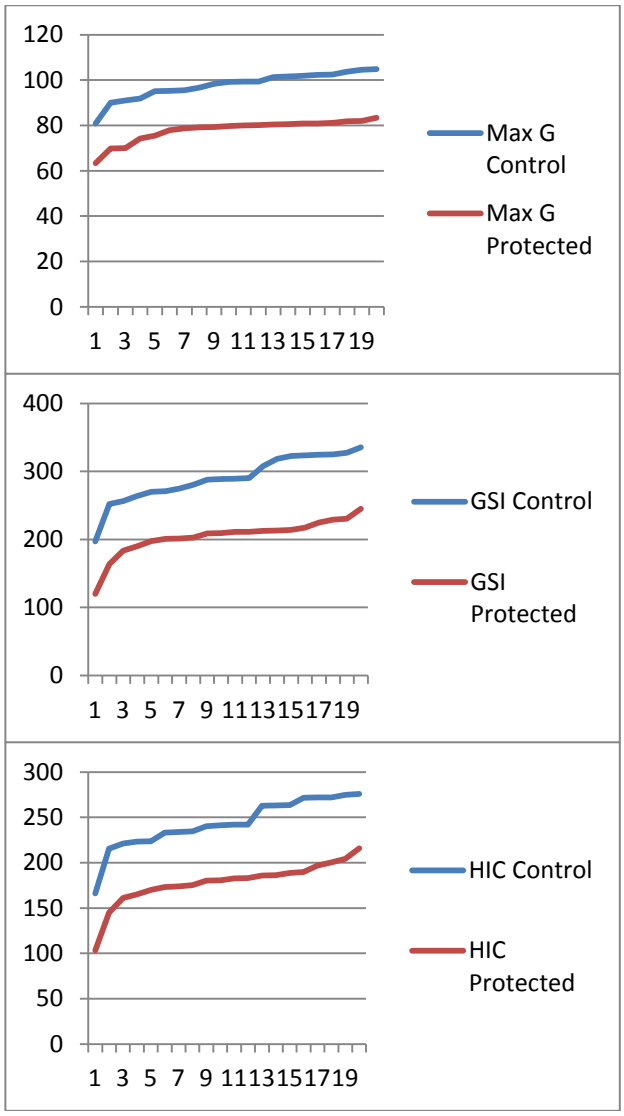
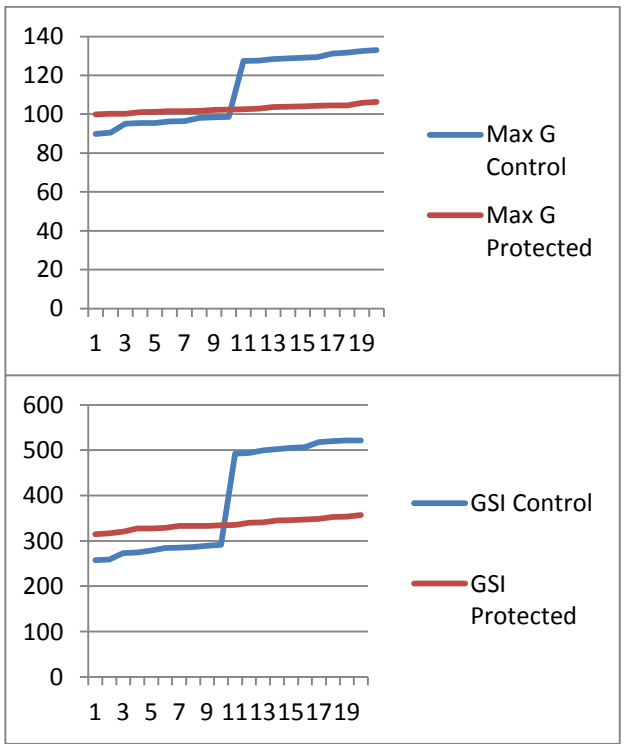
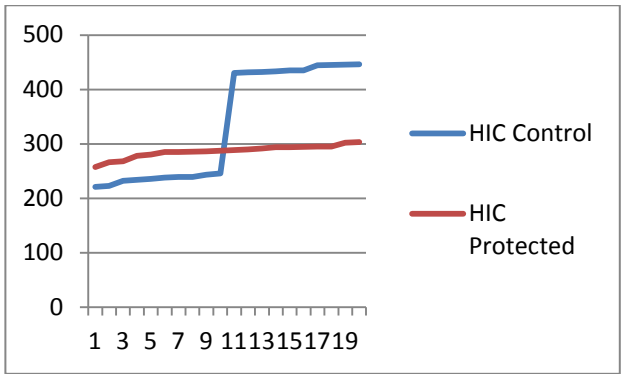


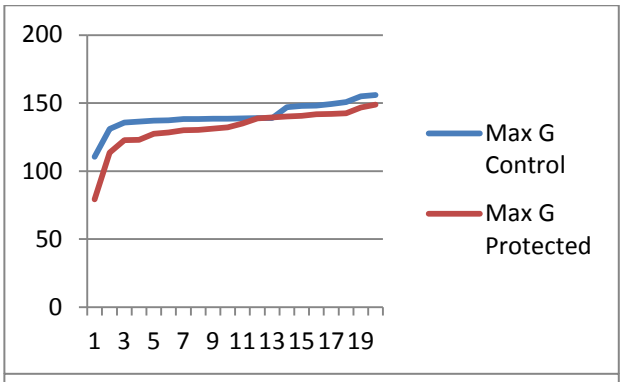
Table 3. 24 Inch RIGHT SIDE

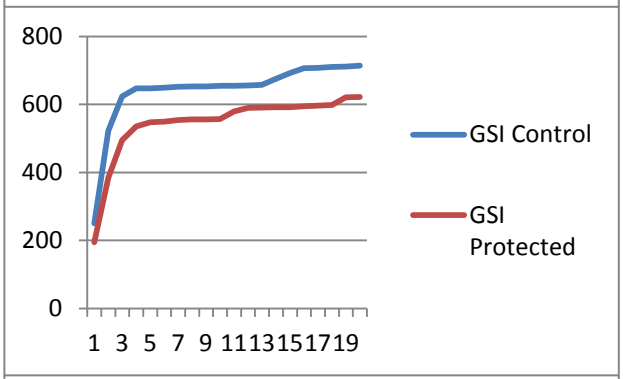
CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
89.88202	257.1164	221.0675	99.96228	314.8462	257.1959
90.53611	258.7136	222.8904	100.2282	316.8623	266.5391
95.11477	273.0411	232.22	100.3173	320.4544	267.9168
95.40338	274.7361	233.8667	101.0535	327.3269	278.166
95.51512	278.7103	235.7872	101.1816	327.3874	280.5143
96.32061	284.4139	237.8399	101.5047	328.618	284.8324
96.44586	284.6272	239.095	101.5806	332.7825	285.1645
98.06737	286.6308	239.417	101.6915	333.1186	285.8234
98.49431	288.8942	243.3752	102.2257	333.3031	286.4928
98.55911	291.0171	245.4412	102.4178	334.3061	287.6239
127.417	492.733	430.1681	102.5276	334.7979	288.6398
127.5771	493.5979	431.4973	102.8859	340.3439	289.6626
128.3529	499.744	432.1722	103.6985	340.985	291.799
128.7827	502.5445	433.137	103.8687	344.9118	293.9094
129.023	505.0117	434.8223	104.0807	345.4295	294.1911
129.4229	506.728	435.1988	104.3155	347.0878	294.5441
131.2217	517.6532	444.6299	104.4877	348.4369	295.0313
131.6982	520.1972	445.215	104.5567	352.9875	295.1286
132.5666	521.6337	445.4214	105.8278	353.2633	301.9432
132.9552	521.6861	446.0079	106.3863	356.8092	303.2555
AVERAGE	112.6678	392.9715	336.4635	102.7399	336.7029	286.4187
STD DEV	17.40775	115.713	101.6019	1.805936	11.80878	11.40577

	Analysis		
	Max G	GSI	HIC
% Change	8.81%	14.32%	14.87%









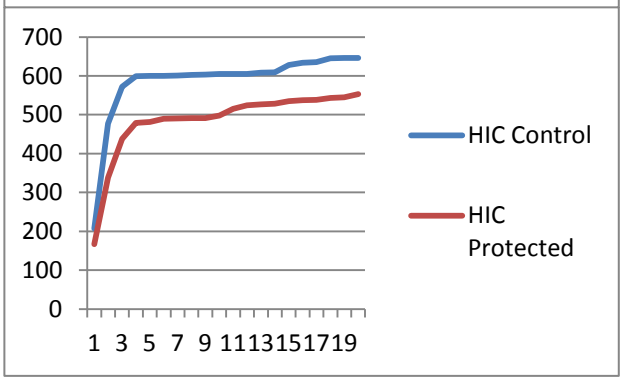


Table 4. 24 Inch TOP

CONTROL			EXPERIMENT		
Max G	**GSI**	**HIC**	**Max G**	**GSI**	**HIC**
110.4233	249.6824	207.043	79.24872	194.7778	167.0251
130.9789	522.8746	477.0215	113.5799	384.628	337.9354
135.6766	624.0237	572.1721	122.6854	494.5256	437.7859
136.4283	647.2692	599.3051	123.0487	535.5989	478.7465
136.9943	647.3388	599.6371	127.4409	547.1711	481.5642
137.4441	648.9792	600.1061	128.4301	549.2501	489.8941
138.3027	652.1635	600.6089	130.0819	553.8765	490.261
138.3716	652.9418	602.1687	130.2436	555.7791	491.1723
138.4051	652.9503	603.0874	131.26	556.0967	491.7413
138.6022	654.2598	604.5595	132.2201	556.5346	497.6453
138.7231	654.4557	605.1058	134.884	579.5815	514.957
138.8789	655.8235	605.2327	138.8141	590.0207	524.1027
138.9075	657.3461	608.6259	139.4475	590.9742	526.3725
146.9272	675.3816	609.2179	140.2223	591.3796	527.9794
147.9033	692.2374	627.6771	140.6937	591.9795	534.6863
148.2386	706.8043	633.7469	141.6965	594.3925	537.3581
149.2685	707.089	635.7462	142.0201	596.0631	538.4831
150.8328	710.0074	645.1053	142.5227	598.0299	543.4368
154.9446	711.1027	645.6974	146.7848	620.5766	545.1493
155.8628	713.7222	645.8718	148.8853	622.1738	552.6824

AVERAGE	140.6057	641.8227	586.3868	131.7105	545.1705	485.4489
STD DEV	9.660472	99.05175	93.87902	14.81614	95.05407	86.88405

	Analysis		
	Max G	GSI	HIC
% Change	6.33%	15.06%	17.21%

Table 5. 60 Inch FRONT

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
142.6116	854.4679	720.651	195.9749	1258.216	1017.585
165.9807	856.9873	735.9408	219.3346	1741.581	1489.772
174.3977	1103.082	948.9592	222.3322	1779.134	1562.118
178.9744	1112.154	949.0427	222.7102	1840.472	1586.139
179.8984	1175.108	998.3759	222.895	1901.135	1648.302
185.2542	1180.562	999.7586	225.0811	1902.224	1654.541
187.6975	1184.454	1006.587	227.04	1913.082	1655.362
188.1681	1206.805	1025.152	228.847	1941.581	1696.666
191.2391	1283.575	1072.455	231.5131	1950.233	1714.153
210.7442	1300.745	1088.177	239.216	2064.332	1807.598
232.8655	1652.773	1401.659			
240.2398	1937.399	1662.438			
243.6104	1965.485	1685.507			
247.0074	2003.259	1727.071			
249.9976	2058.774	1771.03			
251.5986	2131.038	1803.714			
257.0133	2154.615	1808.774			
258.1516	2269.908	1898.558			
263.8467	2345.822	1968.1			
264.3603	2389.366	1979.981			

AVERAGE	215.6829	1608.319	1362.597	223.4944	1829.199	1583.224
STD DEV	37.78769	515.0661	432.1687	10.64028	208.9121	205.9163

	Analysis		
	Max G	GSI	HIC
% Change	-3.62%	-13.73%	-16.19%

Table 6. 60 Inch REAR

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
156.0749	790.3124	684.3516	144.2846	731.0046	627.0512
169.3935	970.7922	838.6636	154.1616	845.4318	718.6677
169.9402	999.2563	843.1013	160.9207	858.9149	741.8283
172.3993	999.5813	849.1947	172.9	995.2594	848.2836
193.3223	1166.59	927.7386	185.6528	1106.229	956.0513
195.7568	1185.1	1004.111	187.4828	1239.932	1059.709
196.1924	1186.307	1004.581	188.6725	1274.857	1089.75
196.7355	1188.26	1009.217	194.5756	1278.233	1090.347
198.6268	1191.195	1011.912	200.609	1283.254	1094.524
202.5716	1240.473	1014.617	201.0739	1289.1	1097.45
203.2771	1242.757	1040.126	202.7518	1292.036	1098.508
205.4813	1247.227	1044.839	202.9951	1295.048	1107.882
206.8706	1289.694	1079.351	203.8005	1345.539	1133.571
213.312	1412.234	1124.953	205.5835	1386.87	1186.717
214.304	1442.94	1169.425	205.8793	1432.758	1200.378
216.5075	1449.831	1201.665	205.9049	1438.666	1213.025
223.7921	1537.971	1245.062	205.9236	1444.903	1228.338
227.9274	1595.138	1304.57	208.3702	1450.842	1237.457
235.0911	1738.371	1411.839	209.7867	1470.123	1241.378
239.5278	1759.715	1444.956	211.9079	1517.703	1295.31

AVERAGE	201.8552	1281.687	1062.714	192.6619	1248.835	1063.311
STD DEV	21.72684	247.2685	189.1272	19.21731	220.7671	184.589

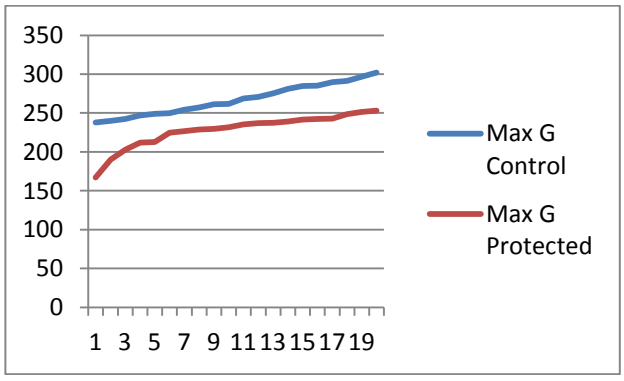
	Analysis		
	Max G	GSI	HIC
% Change	4.55%	2.56%	-0.06%

Table 7. 60 Inch RIGHT SIDE

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
237.953	1694.613	1350.8	167.0347	1000.876	827.3403
239.8477	1720.026	1360.238	189.9687	1242.503	1082.675
242.4333	1789.193	1454.373	202.997	1438.127	1191.822
247.019	1814.113	1485.56	211.927	1540.354	1258.461
248.9503	1846.952	1494.613	212.7349	1541.829	1287.874
249.6056	1849.438	1501.028	224.8387	1591.488	1300.48
254.236	1922.307	1559.313	226.698	1624.506	1318.454
257.3354	2038.011	1620.542	228.9595	1637.676	1322.731
261.4297	2045.978	1626.784	229.5258	1649.862	1346.075
261.6329	2117.253	1675.083	231.7107	1654.622	1396.118
268.8553	2154.036	1708.653	235.2788	1692.51	1410.98
270.8012	2260.207	1829.649	236.8834	1702.934	1457.271
275.4863	2282.684	1837.957	237.2623	1774.685	1457.395
281.1416	2305.595	1871.717	238.9616	1801.937	1458.048
284.8034	2321.171	1892.002	241.4674	1833.647	1460.429
285.0947	2368.71	1892.051	242.5324	1840.228	1483.319
289.5782	2384.197	1903.811	242.7583	1869.126	1496.568
291.5641	2385.307	1911.895	248.4441	1883.371	1507.794
296.6033	2395.045	1912.627	251.6015	1939.226	1551.758
301.8878	2426.884	1932.825	253.2289	1940.332	1559.783

AVERAGE	267.3129	2106.086	1691.076	227.7407	1659.992	1358.769
STD DEV	19.57965	248.3125	197.6072	21.05555	228.2384	171.2

	Analysis		
	Max G	GSI	HIC
% Change	14.80%	21.18%	19.65%



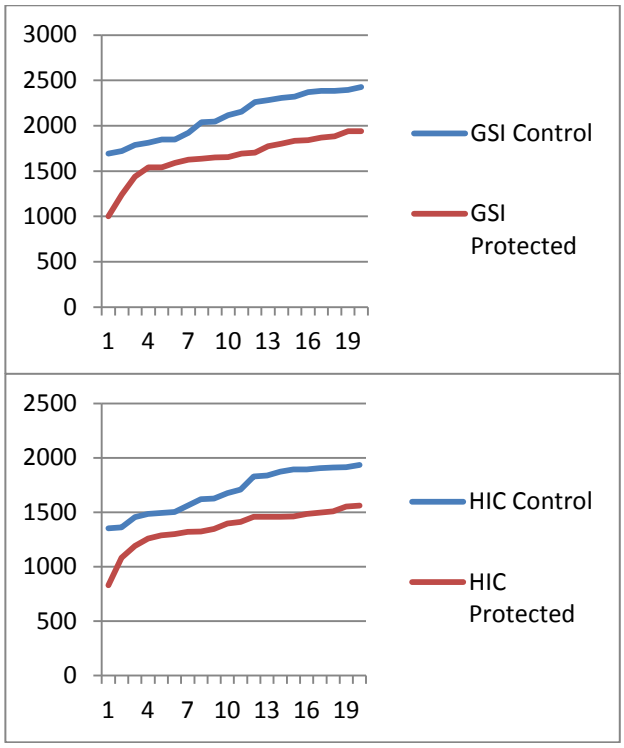
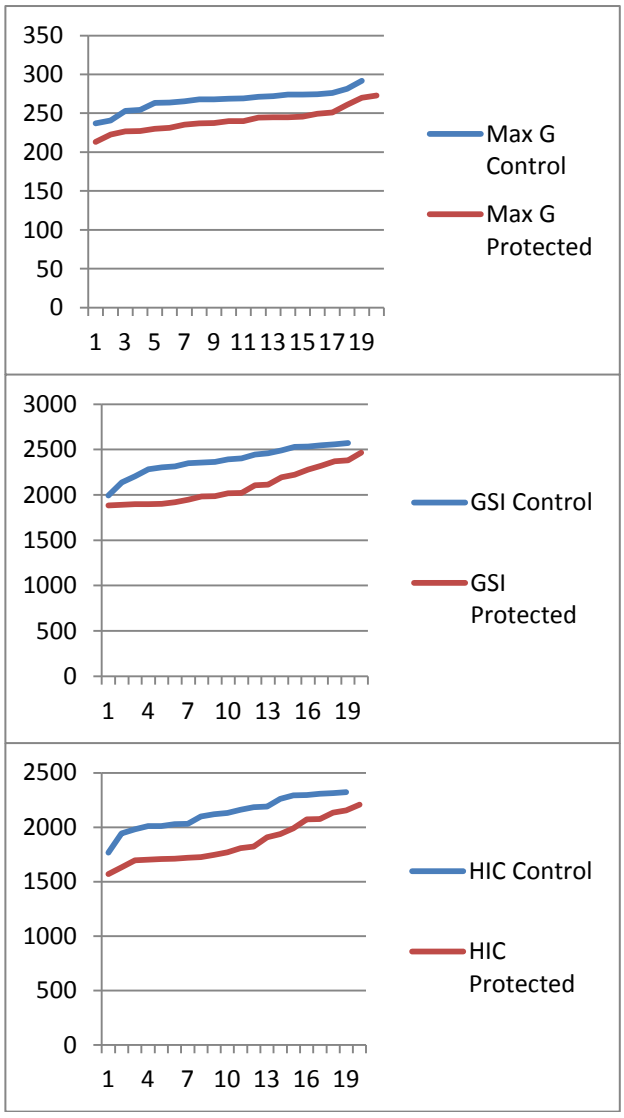


Table 8. 60 Inch TOP

CONTROL			EXPERIMENT		
Max G	GSI	HIC	Max G	GSI	HIC
237.1574	1994.603	1766.55	213.1906	1882.5	1570.849
240.7185	2136.952	1941.857	222.6148	1891.825	1631.109
252.9755	2205.92	1980.302	226.7676	1896.308	1695.3
254.4901	2283.286	2010.797	227.2239	1897.972	1702.297
263.2018	2304.217	2011.579	230.01	1902.232	1709.166
263.8665	2314.641	2028.709	231.2416	1919.514	1709.451
265.282	2349.918	2031.682	235.2306	1945.996	1718.25
267.6956	2355.736	2099.577	236.8729	1982.072	1725.652
267.8268	2362.603	2118.599	237.6263	1985.431	1745.909
268.6187	2393.073	2131.517	239.9485	2016.884	1768.062
269.074	2403.16	2159.827	240.1069	2021.062	1808.245
271.3495	2443.899	2184.226	244.4733	2107.365	1821.85
271.9071	2460.062	2191.357	244.7109	2111.825	1906.638
274.0814	2490.431	2260.615	244.9558	2194.7	1936.487
274.0825	2530.46	2292.825	245.6424	2223.643	1988.735
274.583	2532.697	2295.194	249.1749	2279.994	2072.006
276.3166	2546.113	2308.911	251.1103	2320.625	2075.143
281.6785	2556.569	2313.461	260.9827	2369.558	2135.36
291.7909	2570.377	2323.514	269.7693	2379.918	2154.425
			272.9993	2464.738	2208.34

AVERAGE	266.6682	2380.775	2129.005	241.2326	2089.708	1854.164
STD DEV	12.74308	149.2831	148.7974	14.60354	186.5448	186.5686

	Analysis		
	Max G	GSI	HIC
% Change	9.54%	12.23%	12.91%



TEST PROTOCOL DISCUSSION

All tests were run using "Control" helmets and "Protected, or Experiment" helmets with the coil technology. Carbon fiber was used in a lay-up formation process and vacuum formed. Helmet shape is closely associated with a polo bowl-shaped helmet for ease of process. Tests were run at two drop levels – 24 inches, or 2 feet, and 60 inches, or 5 feet. Calibration procedure follows NOCSAE protocol as set out on the NOCSAE General Standards Document ND-001, including all updates, and for New Polo helmets ND-050 located on their Website: http://nocsae.org/standards/general/. Testing measured g-force, SI, and HIC. Sample sizes met the NOCSAE latest update (NOCSAE DROP - ND002-13m13): 3.2 For any standalone test report; at least two (2) of each model and size must be tested.

What is noted earlier are the results from the 1 inch, 24 gauge steel using ~25% overlap with six layers of carbon fiber and 1 inch, 24 gauge for front, rear, right side and top.

ROTATIONAL ACCELERATION TEST RESULTS PROOF-OF-CONCEPT TEST NOV. 21, 2013

Date of Testing: November 21, 2013
Location of Testing: Virginia Tech - Wake Forest University, School of Biomedical Eng. & Sciences (SBES)
Virginia Tech Testing Staff: Steven Rowson, PhD, Stefan Duma, PhD.

Field: Two "Experiment" Helmets, and two "Control" helmets.

Tate "experiment" helmets used 1" coils, 24 gage steel with ~25% overlap of the coils, and embedded the coil system sealing in with two additional layers of the same carbon fiber and resin used to manufacture these finished production helmets. The "control" helmets had two additional layers of carbon fiber added following the same process.

Below is the chart from Tate Technology's initial proof-of-concept testing held at Virginia Tech-Wake Forest University for the linear impactor test, or pneumatic air cannon, as it is also referred to in testing. This test measures rotational acceleration, and the key culprit in impact force/hits, a dangerous source of brain injury and encephalopathy."

Tate achieved, in these inconsistently fabricated helmets, reduction in both Peak Rotational Acceleration from 3-18%, as well as in Peak Rotational Velocity from 3.5-7%. Due to the nature of the inconsistency of the helmet fabrication in weight, thickness, innumerable air pockets in their production process, results varied on the three impact locations.

Based upon these test results, and recent NOCSAE testing from April through October, 2014 at Tate's laboratory, Tate believes that the results are very promising, and that the both Peak Rotational Acceleration, as well as the Peak Rotational Velocity will also see significant improvement in the reduction and energy attenuation of these forces from this initial testing mirroring our increased linear, SI, and HIC reduction from 11% from the VT tests in November up to 30%. Tate is in continued R&D development and testing of the enumerable designs contained in our patent for "Coil Sports Safety Technology™."

Type	Helmet	Location	Velocity (m/s)	Peak Linear Acceleration (g)	% difference	HIC	% difference	Peak Rotational Acceleration (rad/s/s)	% difference	Peak Rotational Velocity (rad/s)	% difference
Impact	PT 2	front	3.8	107		113		3013		24	
Impact	UP 2	front	3.8	94	-14.21%	121	7.35%	3198	5.77%	25	5.20%
Impact	PT 2	rear	3.8	48		59		2611		21	
Impact	UP 2	rear	3.8	62	22.91%	66	10.69%	2919	10.56%	23	6.94%
Impact	PT 2	side	3.8	68		90		4891		20	
Impact	UP 2	side	3.8	70	3.03%	95	4.41%	4425	-10.52%	20	3.48%
Impact	PT 2	front	5.7	107		215		3909		36	
Impact	UP 2	front	5.7	121	12.32%	266	18.94%	4020	2.76%	37	4.00%
Impact	PT 2	rear	5.7	79		164		4491		32	
Impact	UP 2	rear	5.7	104	24.40%	208	21.41%	5465	17.82%	31	-2.28%
Impact	PT 2	side	5.7	88		199		6778		28	
Impact	UP 2	side	5.7	96	8.25%	209	4.44%	7355	7.84%	27	-1.68%

DISCUSSION POINTS

Tate used multiple impacts per location with rapid succession to address, or closely mirror on-field play. Timeframes differ on the field, but the objective was to look at the "mean" from a multiple hit test session.

Additionally, Tate ran the data from the initial impacts on the test helmets following parameters used by Virginia Tech, and NOCSAE. These results yielded higher results, and Tate shall continue to perform multiple impacts per location, but also shall test to follow process at the NOCSAE approved laboratories with one impact per location, as a comparative analysis.

Additionally, Tate also determined an added side benefit through the multiple rounds of testing, which the Company is in process of continued R&D, development, analysis, and independent testing of the strengthening of the carbon fiber material. Tate performed a separate side-by-side analysis of unprotected carbon fiber and protected carbon fiber with the coil system, and the carbon fiber broke under normal conditions in the control vs. the experiment demonstrated no breakage after the repeated ten impacts. The same occurred throughout the testing of the control versus the experiment helmets.

Without Coil Technology With Coil Technology

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