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NogginLOC Device Testing Report

Introduction: Football helmet studies have examined many types of impacts and safety concerns over the years and the NOCSAE standards have evolved along with the information we have obtained in these studies. One of the major hurdles to any new technology that is an add-on to helmets is that each helmet must be retested in very specific conditions with any individual alteration in order to obtain this seal. Facemasks and chin strap attachments are subjected to this same type of scrutiny, and therefore it is important to make sure that new advances are thoroughly vetted before going to market. As with any new attachment device, testing to determine the strength of the attachment and failure points is essential. One main factor in doing this testing is determining appropriate levels to test the devices. Current literature has safety and impact blow testing measured in acceleration of gravity units (g) for most helmet and facemask testing, which matches up with current NOCSAE approval testing protocols[1-4]. This however is not designed to test pull out strength or shear force to these attachment devices. A second method would be to compare new technology to older/standard technologies, which has not been done recently in the literature. There has been some work done on forces imparted to the mandible through the chin strap with blows to the front and side of the helmet with forces imparted measuring from 568 N at 6.5m/s to 806 N at 9.0 m/s in a frontal blow, but much lower (87 N and 170 N) in a side impact [5]. Our testing in this study was designed to examine the NogginLOC device in these types of forces to determine if they met or exceeded the current technology.

Study Design: Laboratory Study

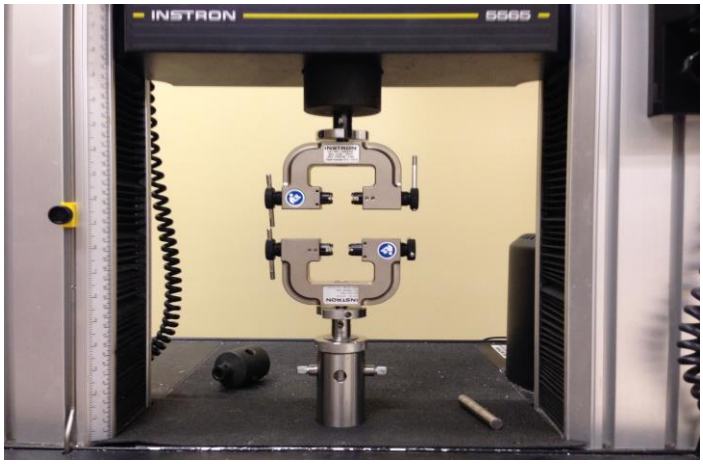
Methods: Two types of testing were done on both the current snap attachment system used on Riddell and Schutt helmets, and the NogginLOC device attachments. The first test was with the attachment devices mounted on a steel plate and connected to a chin strap to determine the strengths of the devices themselves and the second test was with the devices mounted on the helmets in a manner consistent with the method of use on the field to determine if there were any additional differences seen in failure loads. These tests were designed to evaluate pull out strengths and failure mechanisms at extreme loads, therefore testing was done at slow speeds (1000mm/min) with a maximum force of 500N in the steel plate tests and 300N in the helmet tests (difference due to helmet deformation). In preliminary studies pulls from the base of the chin strap anteriorly from the helmet with both straps attached showed no failure of either connection device at 1000 N. In the current evaluation the chin strap was pulled at a 90, 60 and 30 degree angle away from the helmet or steel plate. Traditional snaps were

tested in 6-8 pulls at each angle and the NogginLOC attachments were tested in 4-6 pulls for each angle.

Equipment Used:

Riddell and Schutt Youth Helmets
Standard snap connectors from Riddell Helmet
NogginLOC Chin Strap attachment devices
Instron 5565 Machine with custom clamping bracket

Figure 1 – Instron 5565 with clamping system



Results: The results of this study showed failure loads in the traditional snap connectors to be significantly lower than the NogginLOC attachments, in fact in the NogginLOC attachments there were no failures up to the maximum pull strengths during our testing. (see table 1-2).

TABLE 1 – Steel Plate Attachment Testing

	30 degrees (Newtons)	**60 degrees (Newtons)**	**90 degrees (Newtons)**
Traditional Snap Attachments	56.0 ± 7.0	29.4 ± 5.2	25.9 ± 3.4
NogginLOC Attachment System	All tests > 500.0	All tests > 500.0	All tests > 500.0

TABLE 2 – Helmet Attachment Testing

	30 degrees (Newtons)	60 degrees (Newtons)	90 degrees (Newtons)
Traditional Snap Attachments	194.2 ± 37.4	49.7 ± 12.9	27.1 ± 4.6
NogginLOC Attachment System	All tests > 300.0	All tests > 300.0	All tests > 300.0

Conclusions: There was a significant strength of construct difference between the two connection devices when tested in isolation as well as when they were tested while attached to the helmet. The devices were evaluated in potential planes of pull that could create detachment. In the preliminary testing we noted that forces applied across the helmet in both devices performed very well and above the noted forces from previous studies expected to be applied by the mandible with frontal blows[5], but in side blows there is still question as to whether or not the traditional connection devices can withstand the forces previously observed[5]. The testing for the NogginLOC attachment did however show a lack of failure at loads exceeding those reported values. Speed of force transmission is a significant component in this determination, and multiple speed testing was not conducted in this testing. In addition fatigue testing was not part of our protocol either and continued use over time could affect the results in either or both devices.

References:

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