Simulated Autonomous Aerial Vehicle Impacts to the Pediatric Head

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Background and Objectives

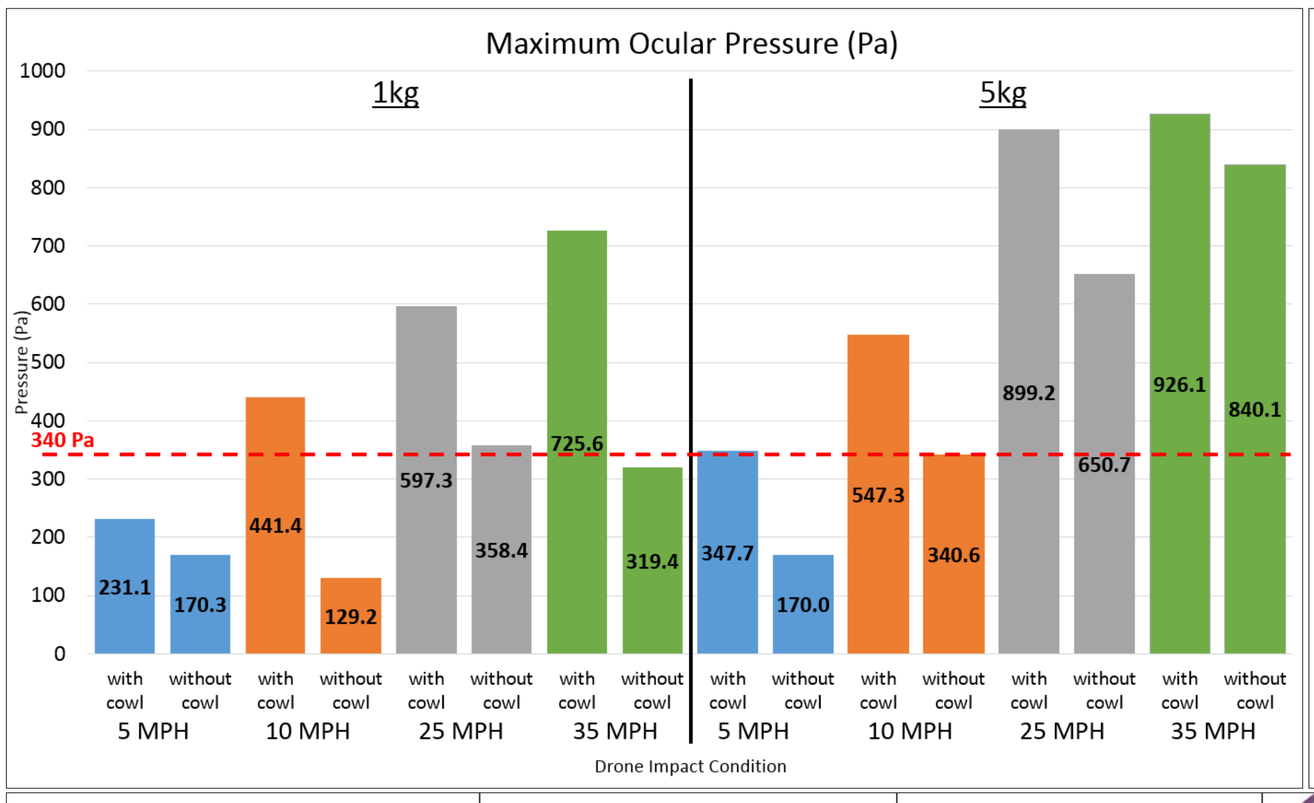
- Number of autonomous aerial vehicles increasing for consumer and commercial use
- It is important to study the injury implications of potential crash impacts with these vehicles
- The objective of this project was to gain insight into injuries sustained to the pediatric head by using simulated autonomous aerial vehicle impacts with the PIPER 6-year-old human body finite element model

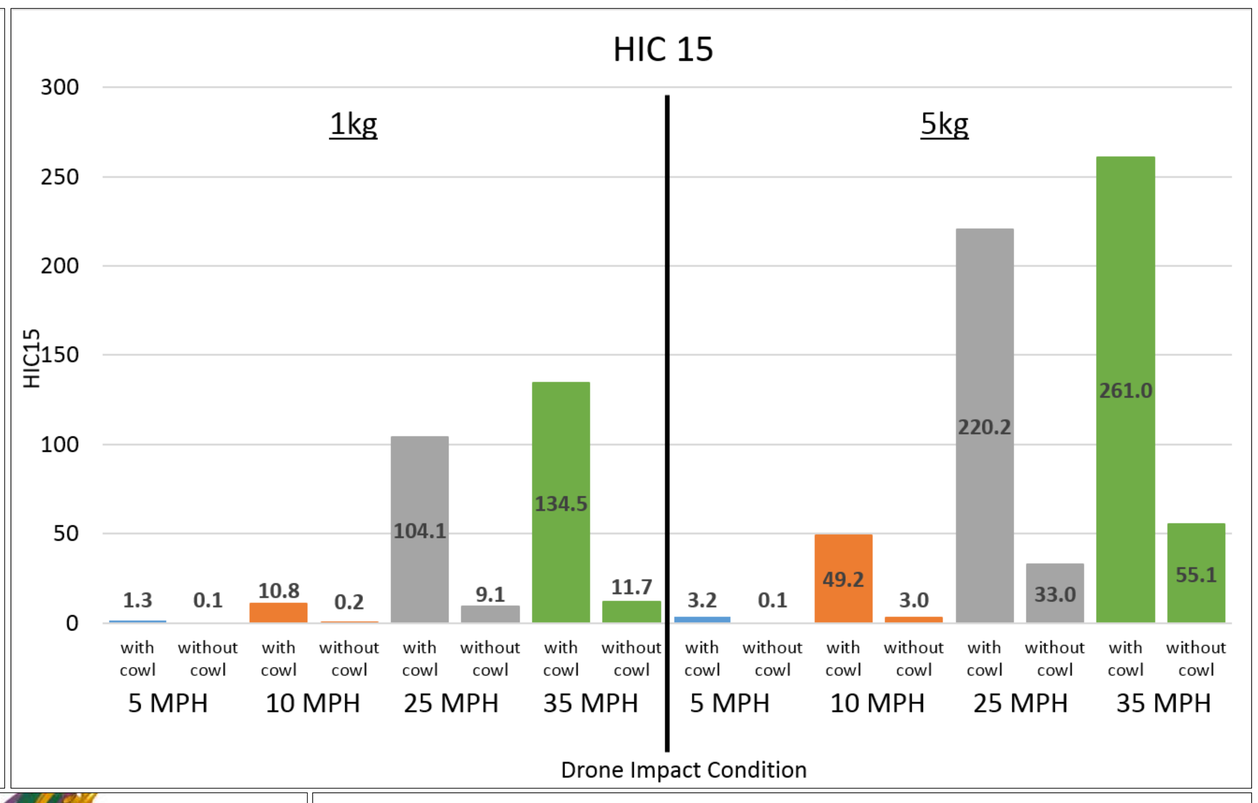
Computational Model Setup

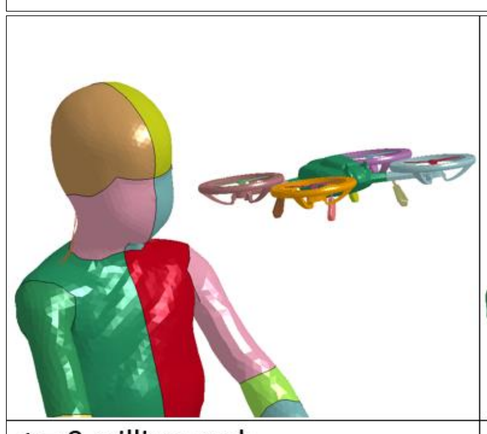
- 16 simulations were setup by varying three parameters: Rotor with and without an external cowl, mass 1 kg and 5 kg, and velocity of 5mph, 10mph, 25 mph, and 35mph were used
- Head, chest, and pelvis accelerations, HIC, and surface ocular pressure were extracted and compared with each other.

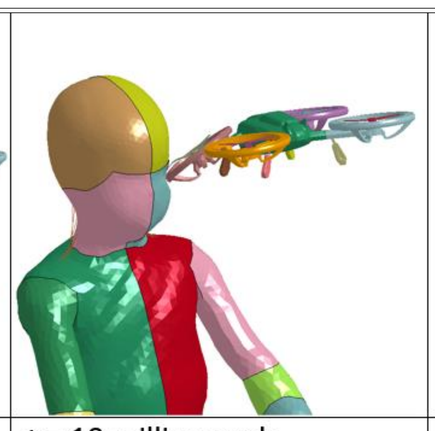
Data/Results

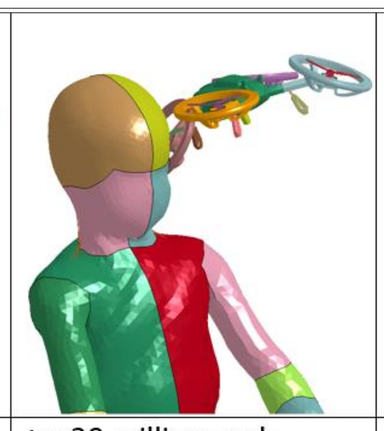
- From the simulations it is observed that at higher speeds even with a considerably small weight of 1kg , the child's head is pushed back causing an extension in the neck
- The angular change in position of the head before and after the impact, measured from the C7 vertebra is about 18.39 degrees
- The rotor without cowl has lower absolute ocular pressure as compared to the rotor with an external cowl for the same speed
- The 5kg drone has greater ocular pressure and head resultant acceleration compared to the 1kg drone for the same speed – mass effect
- Rotor with cowl impact suggests possibility of ocular injury at higher speeds according to experimentally recorded threshold for retinal detachment (340 Pa)

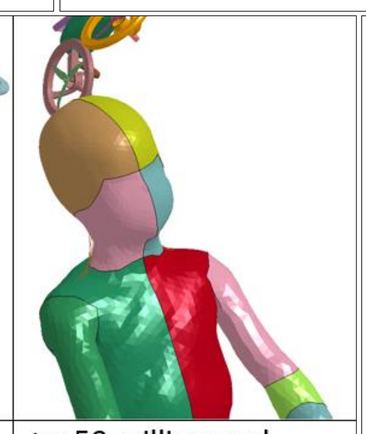


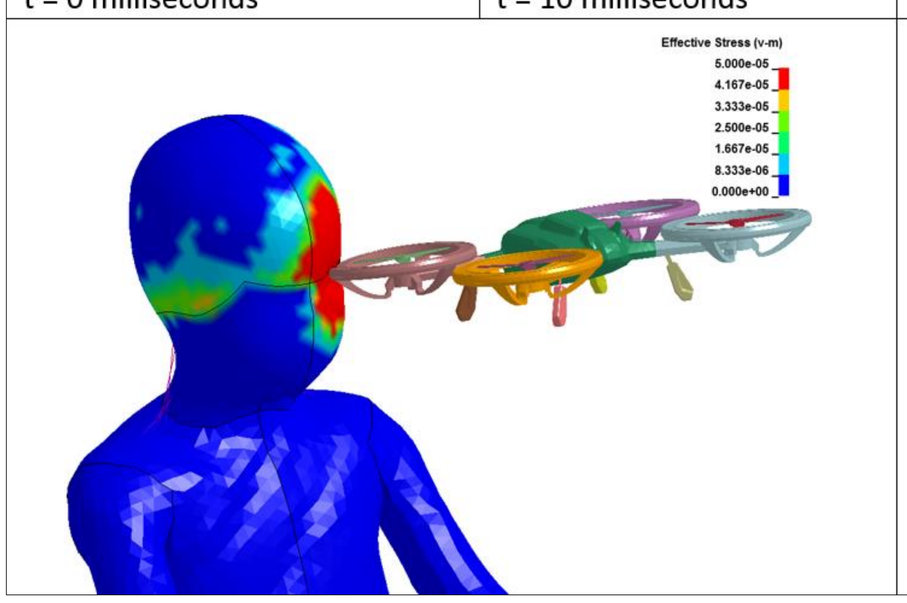


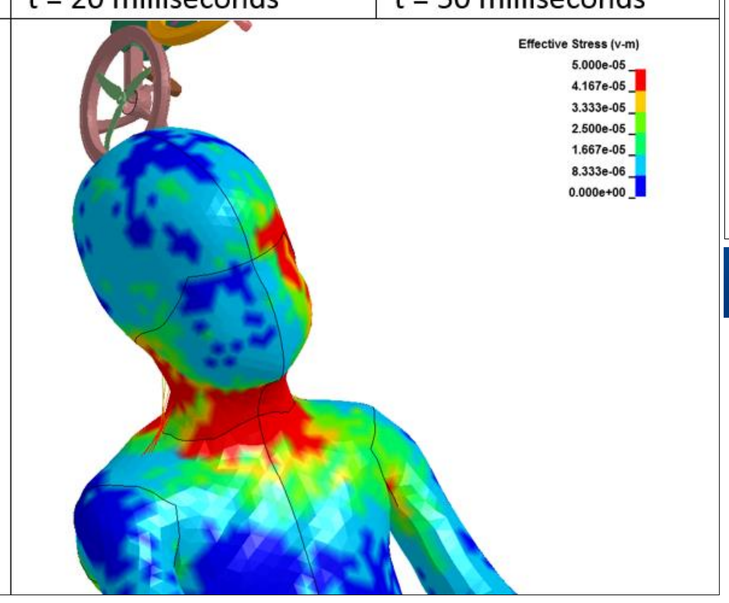


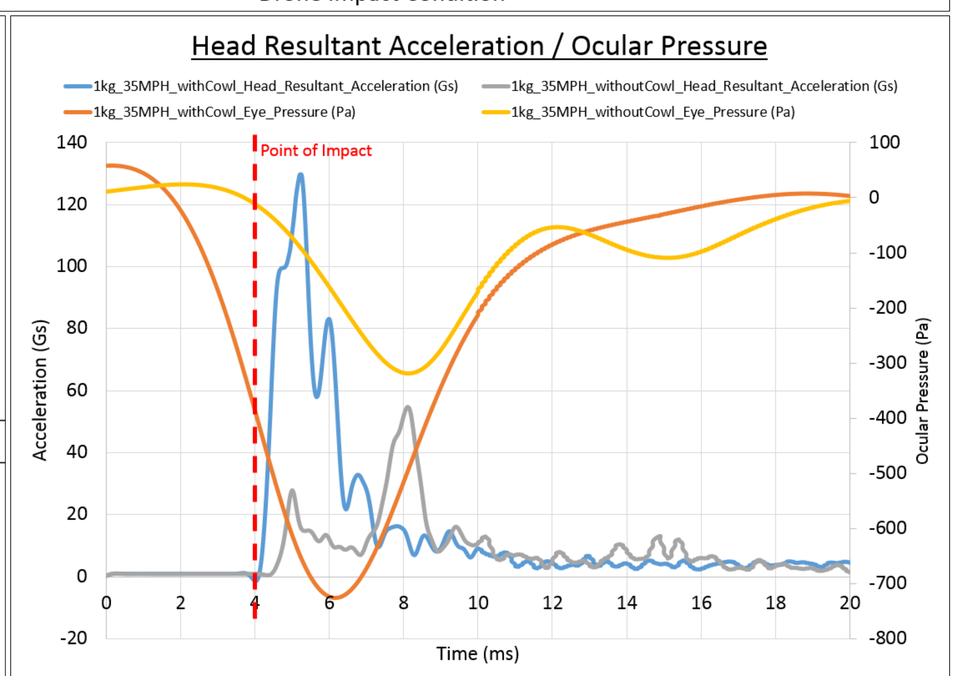












Limitations

- This study does not account for the rotation of the rotor blades
- Material properties/shape of the cowl need to be further examined.
- Detailed model of eye to be studied