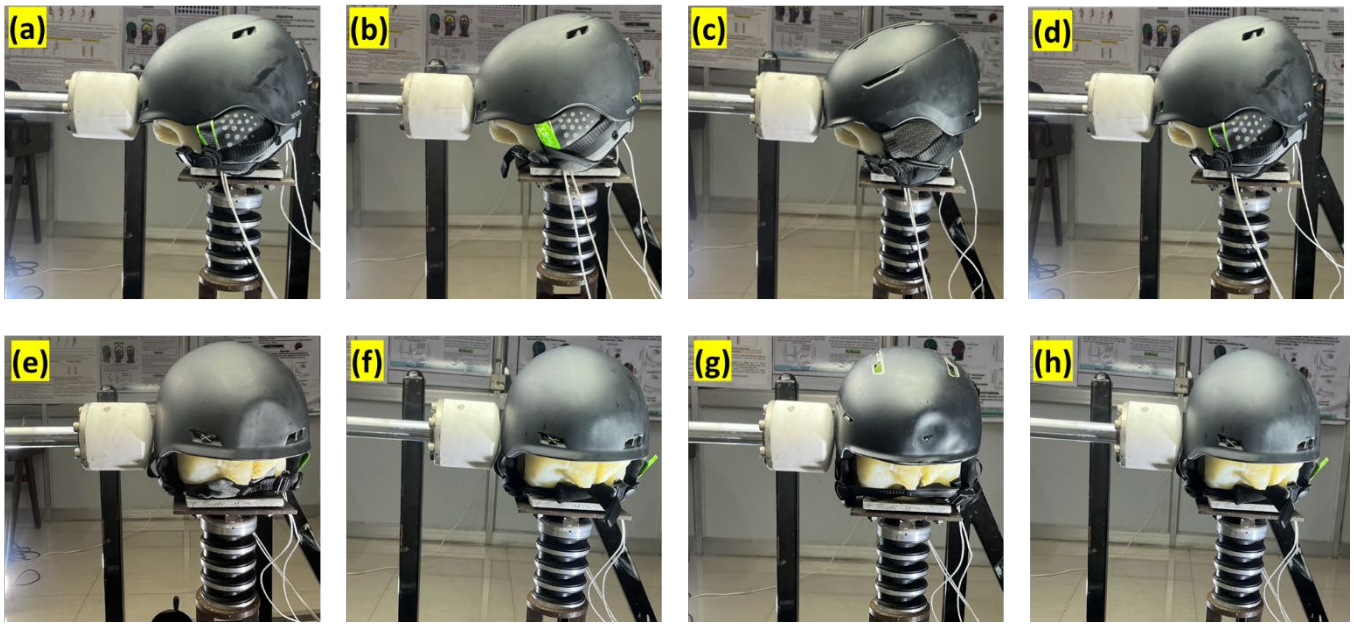
Supplementary material

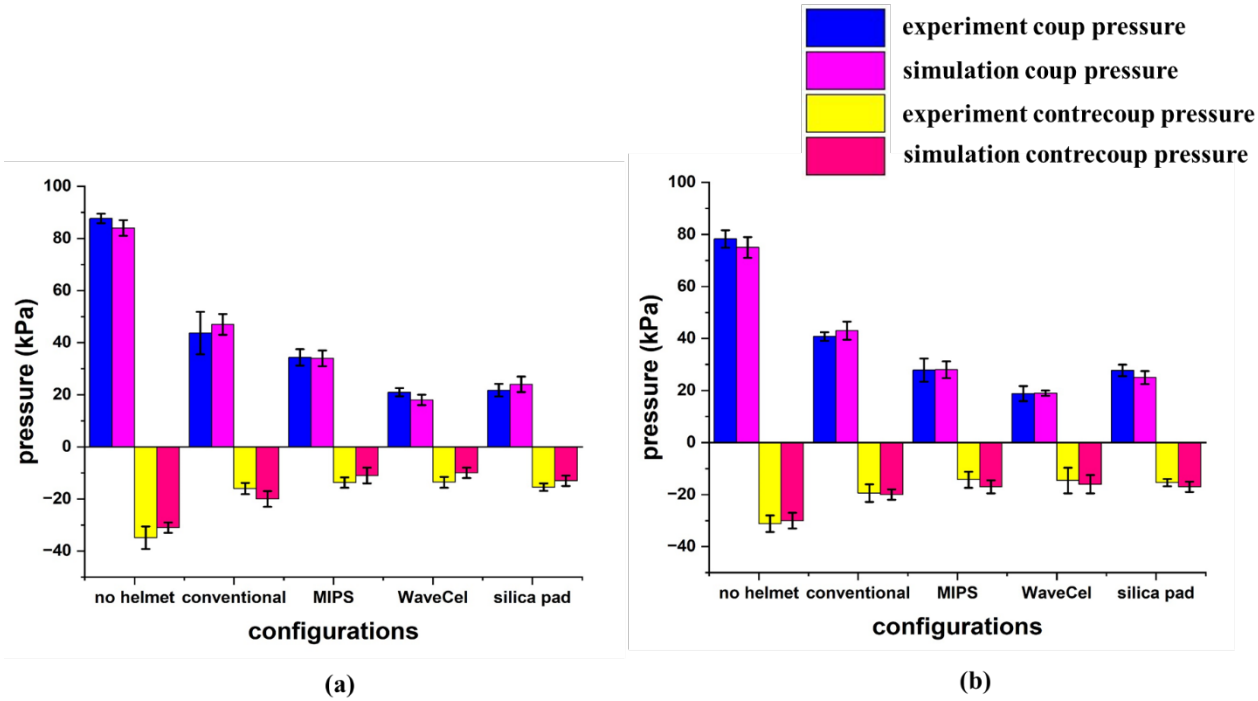
Comparison of brain simulant pressures of head surrogate against intracranial pressure data in post-mortem human subjects (PMHS):

Brain simulant pressures of head surrogate were compared against intracranial pressures measured in PMHS [1] subjected to blunt impact. Two sets of intracranial pressure data from PMHS experiments (experiment nos. 48 and 37 [1]) were considered. Blunt impact experiments on the head surrogate were conducted using a linear impactor system to facilitate the comparison of pressures from PMHS experiments. Details of the linear impactor system are available in the methods section of the main manuscript. For each set of experiments, five repetitions (N = 5) were considered. In this work, the impact energies of 50 ± 3 J and 255 ± 15 J were used for the blunt impact on the head surrogate. These impact energies for the head surrogate were closely matched (< 7% difference) with that of PMHS (Nahum et al. [1]) experiments (experiment nos. 48 (impact energy 48 J) and 37 (impact energy 276 J)). Coup and contrecoup pressures between the head surrogate and PMHS were compared.

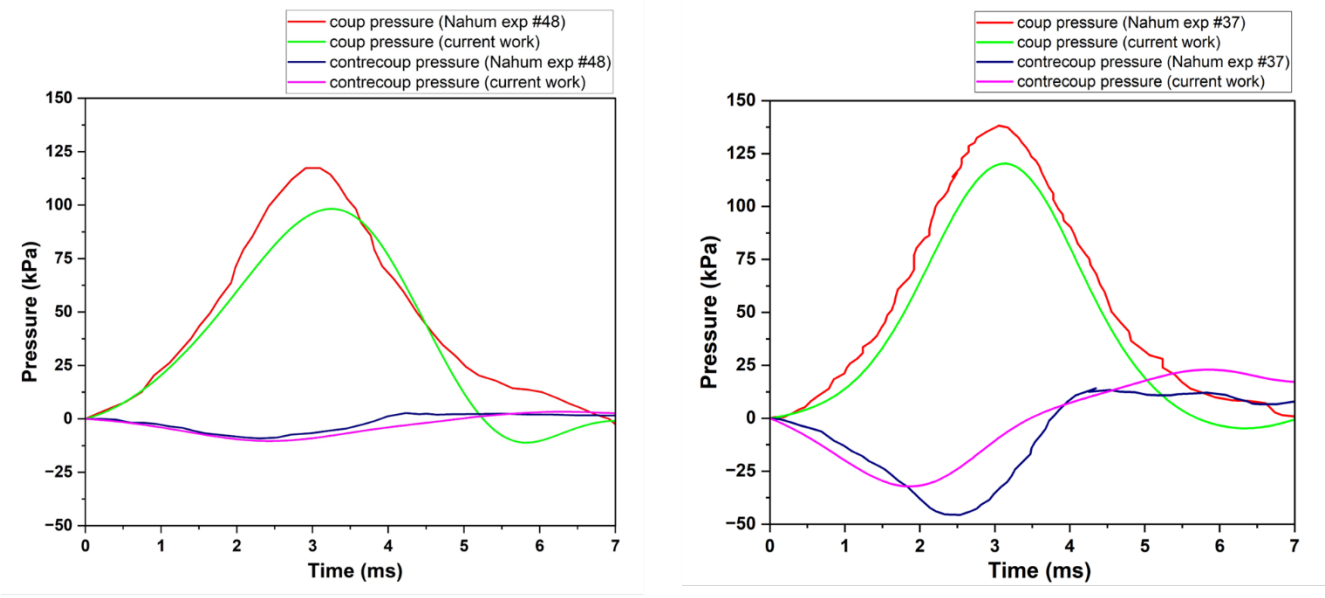
We found reasonable agreement between experimentally measured brain simulant pressures in the head surrogate and intracranial pressures reported in PMHS in terms of peak values (<15% difference), and temporal evolution (supplementary Fig. 3). The reasonable agreement between experimentally measured brain simulant pressures and intracranial pressures in PMHS is attributed to the similar bulk modulus between brain simulant (2 GPa [2]) used in this work and PMHS brain (~2 GPa [3]). The brain pressures are preliminarily governed by the bulk modulus of the brain [4] and are relatively insensitive to other geometric and material parameters [5].



Supplementary Fig. 1: a, b, c, d represents the photographs of head surrogate equipped with conventional, MIPS, WaveCel, silica pad helmets, respectively, subjected to blunt impact (front orientation); e, f, g, h represents the photographs of head surrogate equipped with conventional, MIPS, WaveCel, silica pad helmets, respectively, subjected to blunt impact (side orientation).



Supplementary Fig. 2: Coup and contrecoup pressures in the head surrogate for various configurations (experimentally measured and computed from simulation). (a) front orientation (b) side orientation.



Supplementary Fig. 3: Comparison of brain simulant pressures of head surrogate against intracranial pressure measured in PMHS (Nahum et al. [1]) (a) blunt impact on the head surrogate with impact energy of 50 ± 3 J was compared against PMHS experiment no. 48 (corresponding energy 48 J) of Nahum et al. [1] (b) blunt impact on the head surrogate with impact energy of 255 ± 15 J was compared against PMHS experiment no. 37 (corresponding energy 276 J) of Nahum et al. [1]. For experiments on head surrogate, five repetitions (N = 5) were considered for each energy level. The presented pressure-time histories of current work are based on the average of five repetitions.

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