Measuring In-Vehicle Child Comfort to study barriers to appropriate and correct use of restraints

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1. Background
Traffic crashes are the leading cause of death and injury among children aged between 4-14 years7,8 and premature graduation to adult seat belts6,9 and restraint misuse10 are common and known risk factors. Children are believed to prematurely graduate to adult belts and misuse the seat belt in booster seats if uncomfortable11,12. However, research has concentrated on educating parents and designing better restraints to reduce errors in use, the impact of comfort of the child in the restraint has not been studied. Currently there is no existing method for studying comfort in children in restraint systems, although self-report survey tools and pressure distribution mapping is commonly used to measure comfort among adult in vehicle seats13,14.

This poster presents preliminary results from work aimed at developing an appropriate method to measure the impact of comfort of children in vehicle restraint systems. The specific aims are to:

1. Examine the potential of using modified adult self-report/survey and pressure distribution mapping in children
2. Develop a video based, objective measure of comfort in children.

5. Results
20-Point Comfort/Discomfort Survey
- No significant differences between the mean survey score and seating conditions
Pressure mapping
- Shifts in pressure distribution related to lengthening of cushion length and introduction of footrest observed.
- DAB correlated with ΔCOF (p=0.01)
- ACA for CL (M=35.12, SD=4.45) was significantly larger than F (M=30.79, SD=4.99) (p=0.01, paired samples t-test). No significant difference observed in other conditions.

6. Discussion and Conclusions
Initial results indicate a survey approach to measuring comfort in children in vehicles and restraint systems may not be as useful as video observation or behaviour. A significant relationship between child discomfort measured using the video based DAB rate and poor sash belt geometry was observed. DAB may be a promising measure to study real versus perceived discomfort in children in child restraints.

The modified 20-point comfort/discomfort scale appears unsuitable as children appear to have difficulty rating their comfort in the level of detail required for this instrument. To address this, we have revised this instrument to group various body areas into a simpler six zone survey and will test this revised instrument in our future work.

Pressure mapping is commonly used in assessing in-vehicle comfort in adults, but the usefulness of this measure in quantifying differences in comfort levels is debated1. In this preliminary work pressure mapping has demonstrated significant differences in ACA between the F (comfortable) and CL (lower torso uncomfortable) conditions. This may indicate a postural shift adopted by children in response to the CL uncomfortable condition. Notably, no significant difference between F and CL in DAB was observed. This may be due to the postural shift improving comfort; however this likely involves the child adopting an undesirable slouched position. This will be investigated in more detail in future work.

Pressure mapping maybe a useful tool for studying postural shift in children but to date there is no evidence that it is likely to be useful in the study of comfort. The Tekscan system currently being used has not been appropriately calibrated and this has prevented the use of measures based on peak pressure. Future work will explore the relationship between peak pressure measurements and comfort.

The methods being developed by in this study will be used to study real versus perceived barriers to appropriate child restraint use as well as improving the design of restraints to reduce the incidence of misuse. From this preliminary work, the most promising method appears likely to be video analysis and the DAB measure.