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Are gain values significantly altered by manual data selection when performing the video Head Impulse Test (v-HIT) on all six semicircular canals with two different v-HIT systems.

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Introduction

Video Head Impulse Test (v-HIT) systems often have detection algorithms integrated in their software that detect head impulses containing either head or eye movements that do not meet certain predefined criteria. It is, however, often a prerequisite for the examiner to manually clean up the dataset upon completion of the v-HIT due to artifacts.

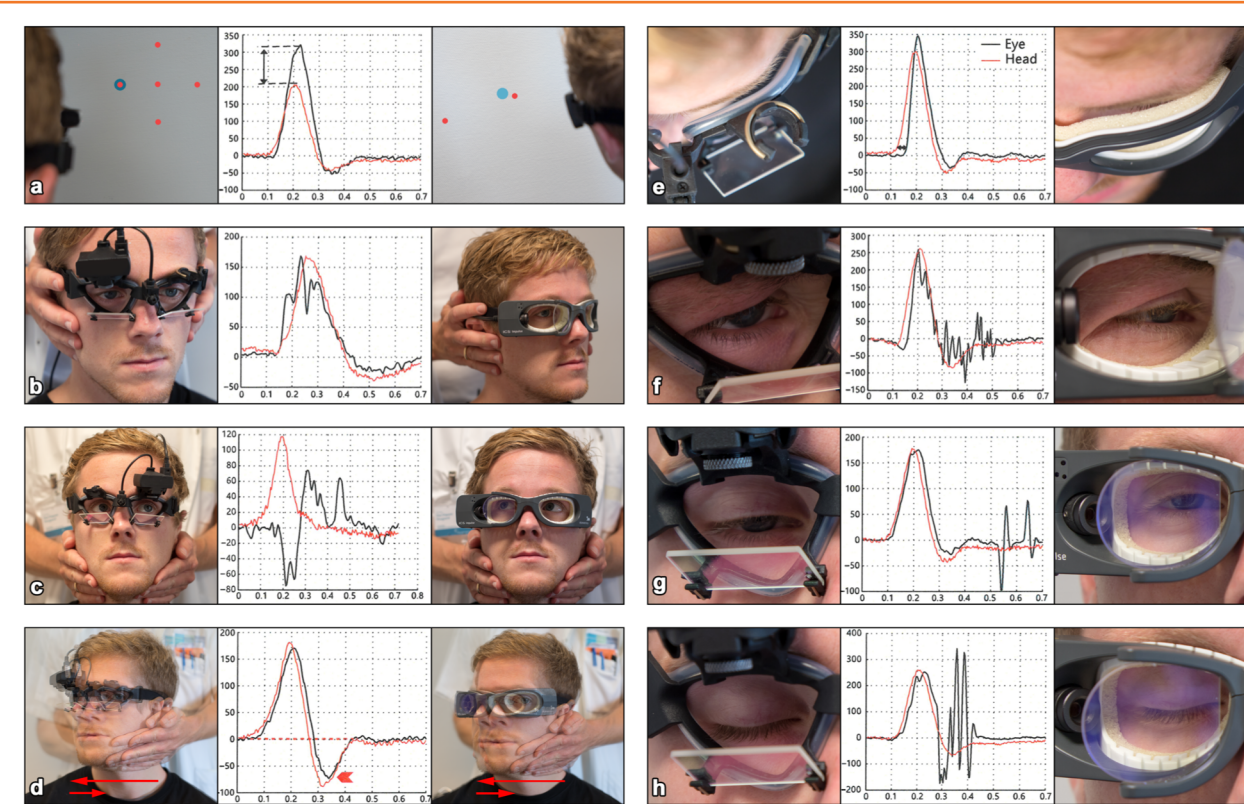


Figure 1: Different types of artifacts. Images: EyeSeeCam® (left side), ICS Impulse® (right side). Graphs (mid section): Wrong calibration (a). Touching goggles (b). Patient inattention (c). Head overshoot (d). Goggle slippage (e). Pupil tracking loss (f). Mini-blink (g). Blink (h).

Objective

To evaluate whether the gain values of all semicircular canals (SCCs) are significantly altered by manual cleaning using two different v-HIT systems.

Material and Methods

120 subjects with previously neither vestibular nor neurological disorders underwent four separate tests of all six SCCs with either EyeSeeCam® or ICS Impulse®.

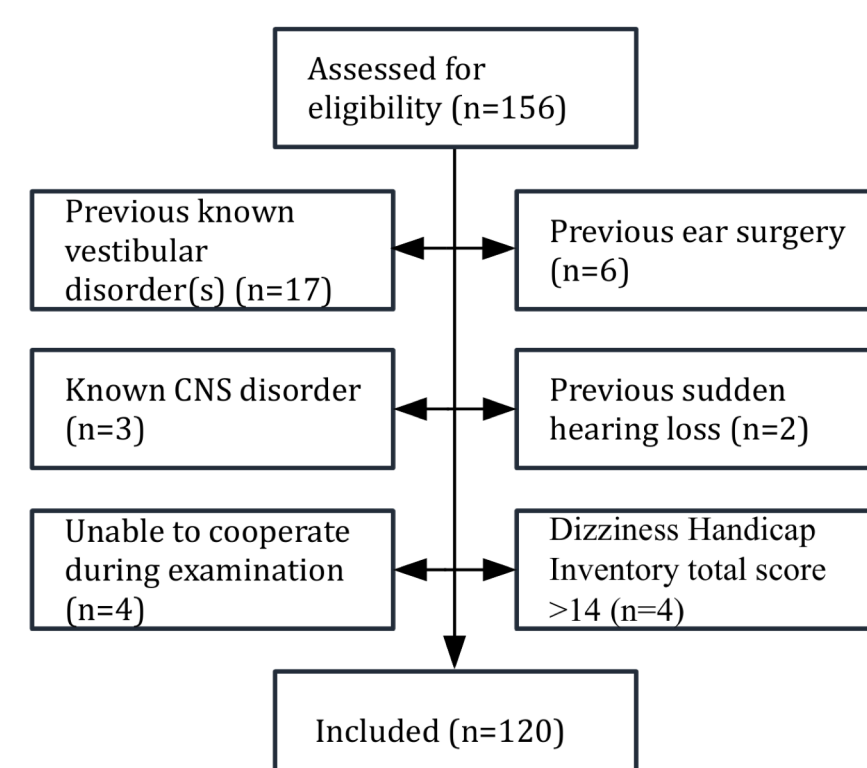


Figure 2: Trial profile.

An experienced ENT Specialist did two complete tests, and two tests were done by a medical student. All tests containing noise/artifacts or outliers underwent manual data selection by the experienced ENT Specialist. A paired T-test was performed to compare mean gain values based on unsorted data and gain values based on the sorted data.

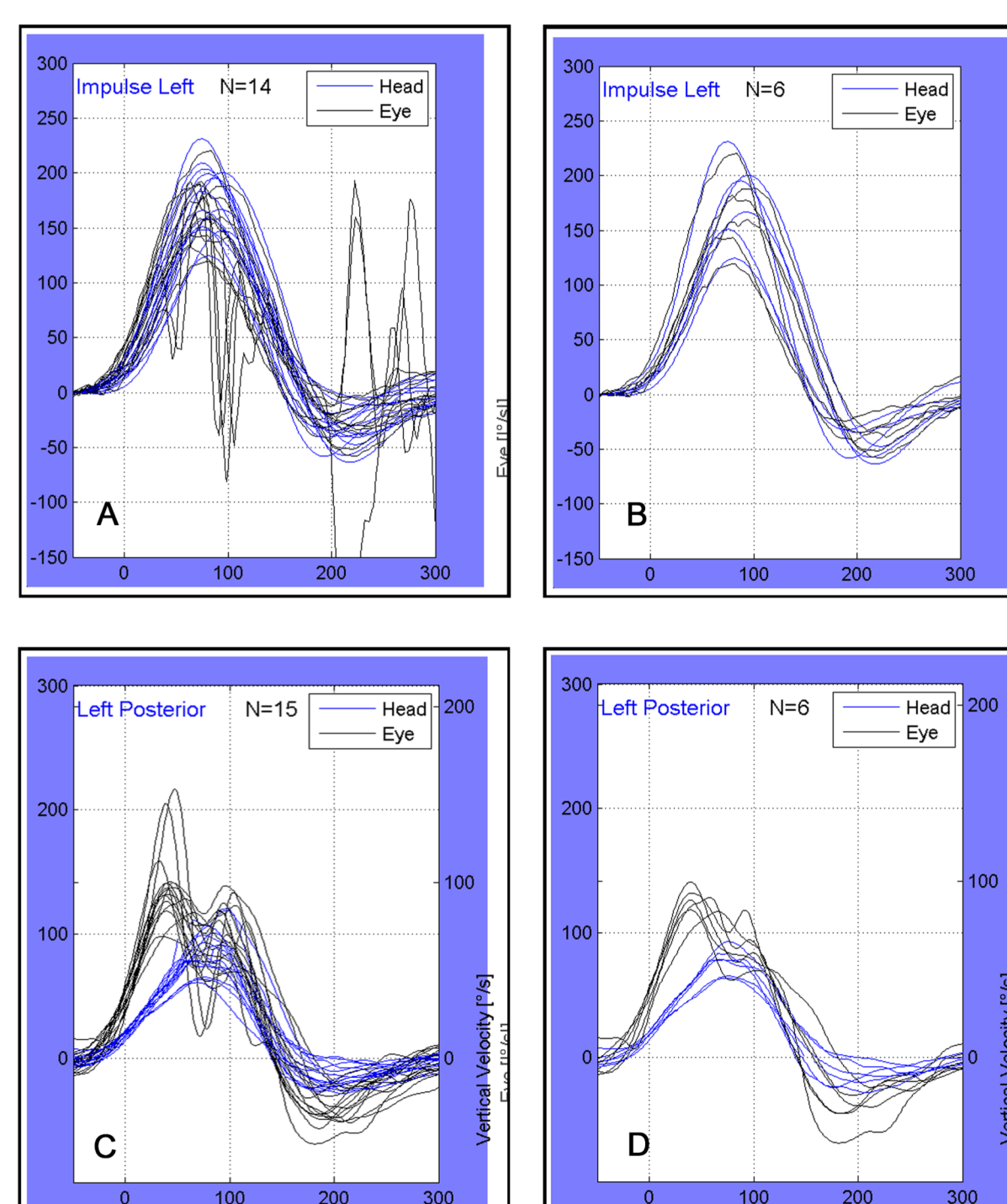


Figure 3: EyeSeeCam® graphs representing tests affected by noise before (A,C) and after manual data selection (B,D).

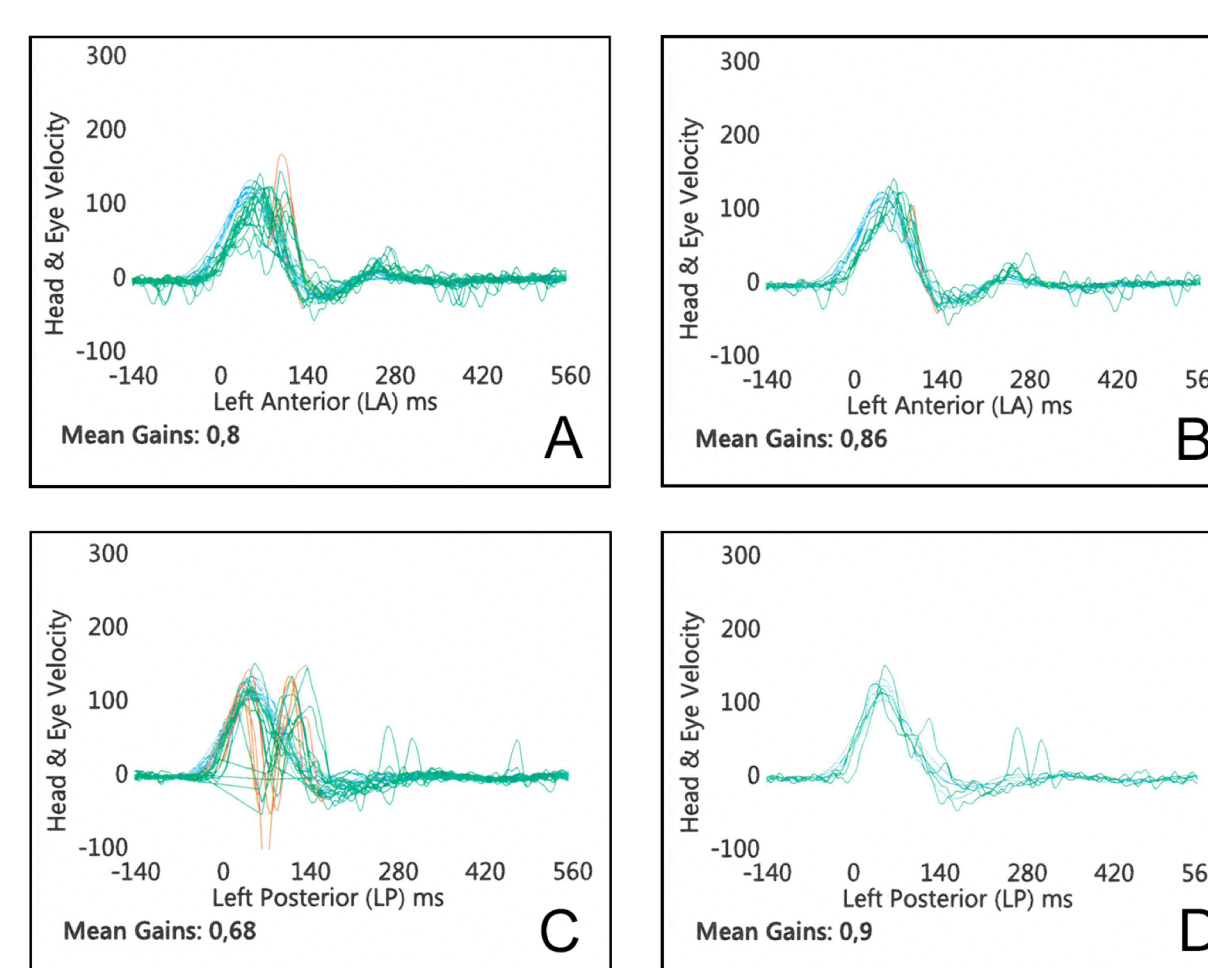


Figure 4: ICS Impulse® graphs representing tests affected by noise before (A,C) and after manual data selection (B,D).

Results

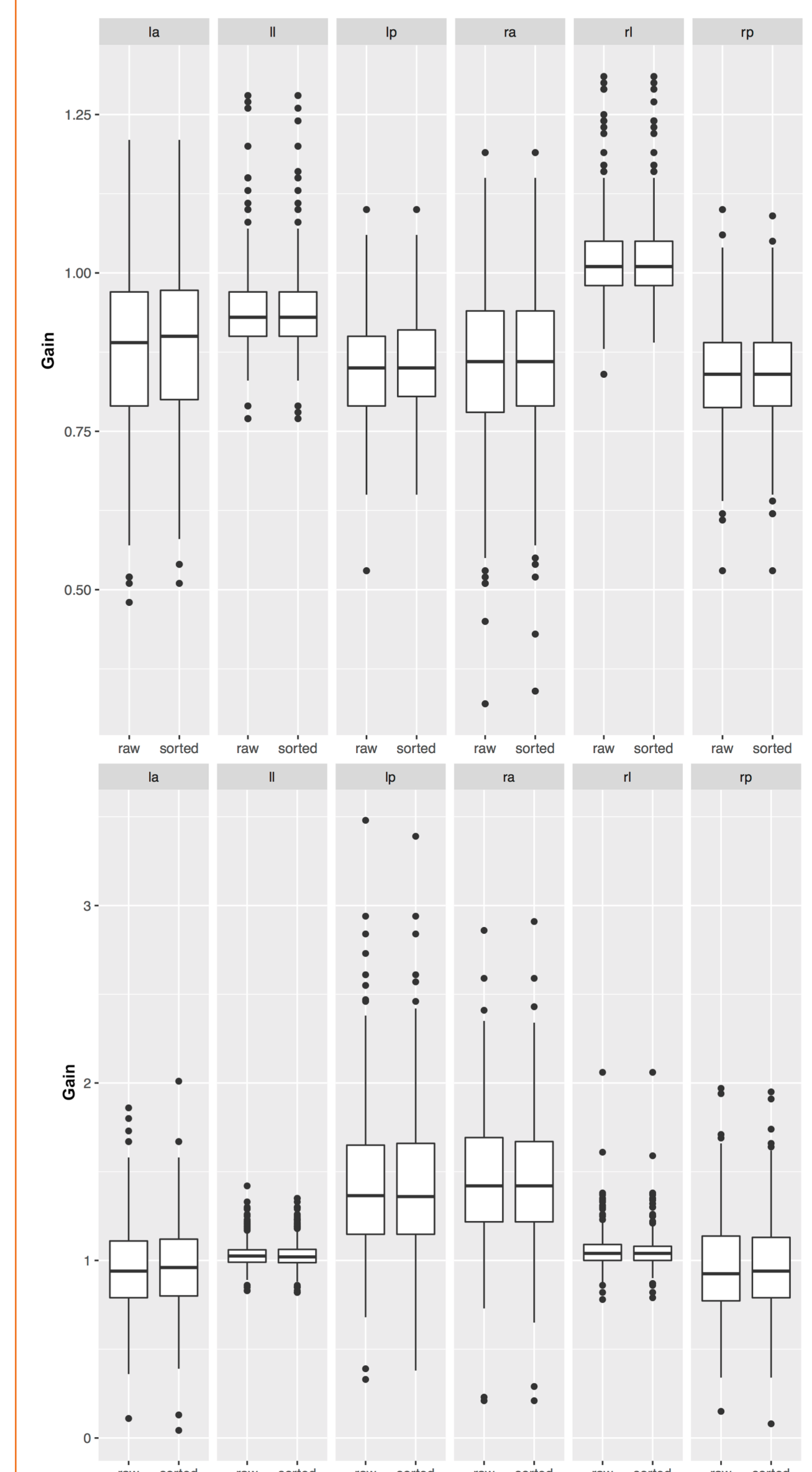
Based upon the unsorted and sorted dataset, a paired T-test showed significant differences of the vertical SCC mean gain values with ICS Impulse®.

No significant differences were found with EyeSeeCam® (all six SCCs) and with ICS Impulse (the two horizontal SCCs).

	Estimate	P-value	95% CI Lower	95% CI Upper
EyeSeeCam				
Right lateral	0.00088	0.69	-0.00131	0.00139
Left lateral	0.00004	0.95	0.00345	0.00520
Right anterior	-0.00858	0.27	-0.00741	0.00974
Left posterior	0.00345	0.57	-0.02393	0.00676
Left anterior	0.00637	0.27	-0.00497	0.01771
Right posterior	0.00117	0.79	-0.00849	0.01539
ICS Impulse				
Right lateral	0.00159	0.06	0.00007	0.00325
Left lateral	0.00071	0.26	-0.00052	0.00194
Right anterior	0.01357	0.00	0.00961	0.01753
Left posterior	0.00787	0.00	0.00426	0.01147
Left anterior	0.01017	0.00	0.00684	0.01349
Right posterior	0.00217	0.05	0.00003	0.00430

Table 1: The estimate indicates the average difference between gain values based on unsorted data and gain values based on sorted data. P-values below or equal to 0.05 indicate significant difference between gain values based on unsorted data and gain values based on sorted data (shown in bold). Upper and lower boundaries for the 95% Confidence Interval (CI) are also listed in the table.

In total, more impulses were deleted with EyeSeeCam®. However, larger differences between mean gain values based on the unsorted and the sorted data were seen with ICS Impulse®. A linear mixed effects model showed that the level of examiner experience did not influence the need for subsequent manual data selection.



Figures 5 & 6: EyeSeeCam® and ICS Impulse®, respectively, boxplots based on mean gain values. Top and bottom of each box represent the first and third quartile, whereas the band inside the box represents the second quartile. The vertical lines indicate the lowest and highest mean gain values within 1.5 interquartile range. Outliers are plotted as circles.

Conclusions

Mean gain values for all six SCCs with EyeSeeCam® and mean gain values for the lateral SCCs with ICS Impulse® were not significantly altered by manual data selection. However, manual data selection following vertical SCC testing with ICS Impulse® did significantly alter mean gain values. None of the two vHIT systems, however, showed any clinically important effect(s) of manual data selection.

Finally, level of examiner experience did not have any influence on the impact of manual data selection.