

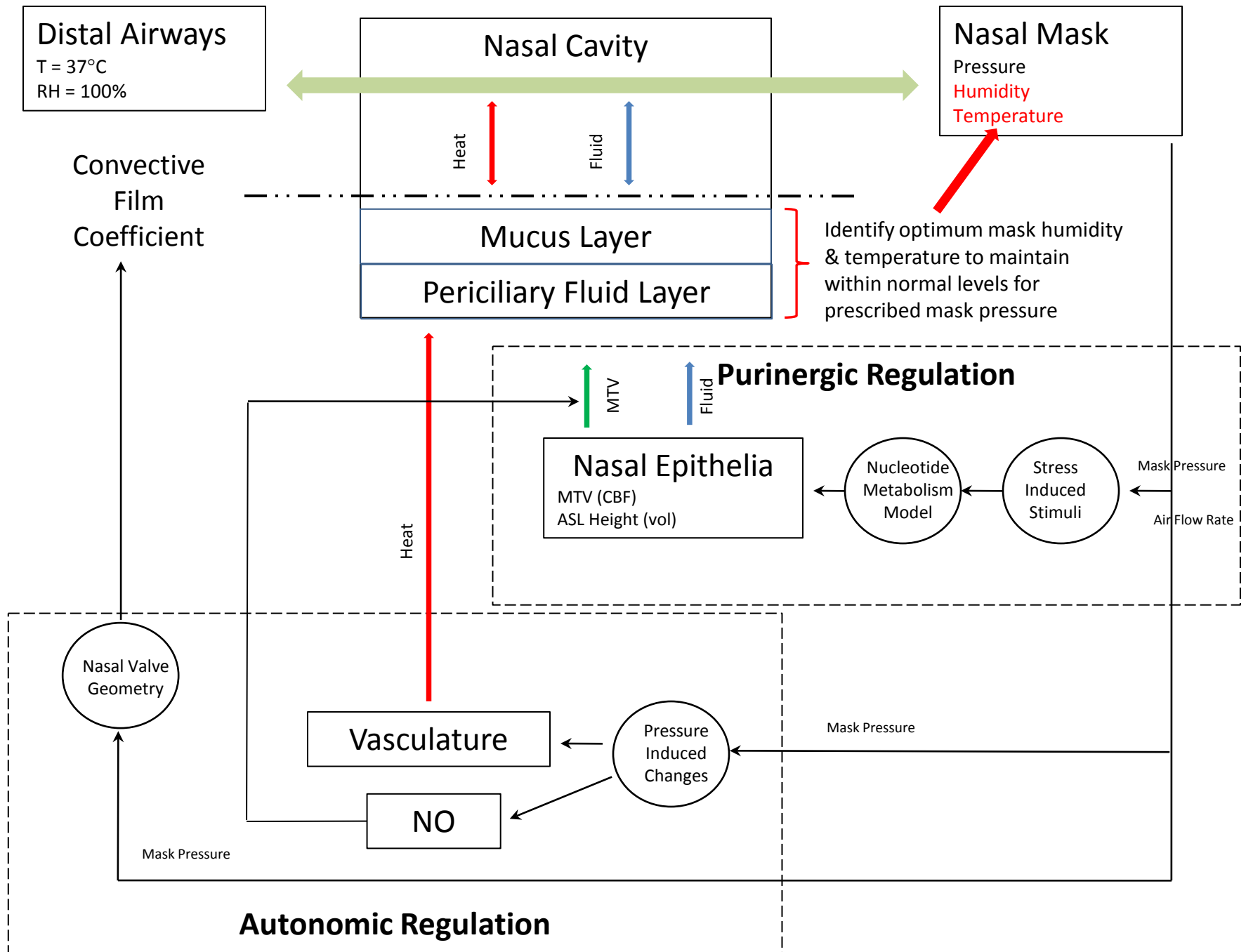
Nasal Morphology and Blood Flow During Augmented Air Pressure Therapies

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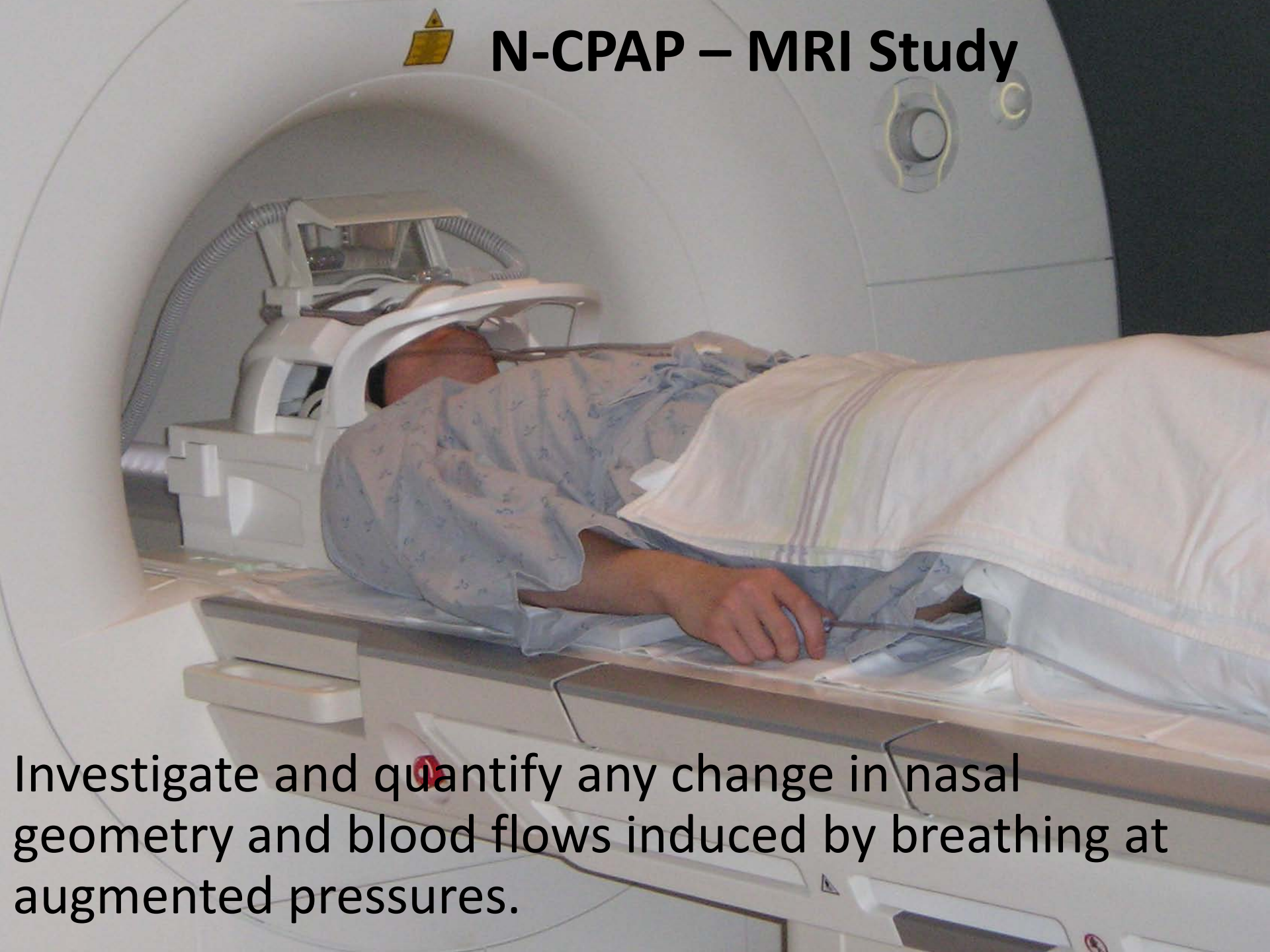
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N-CPAP – MRI Study

A patient is lying on an MRI table, positioned inside the circular gantry of an MRI scanner. The patient is wearing a nasal cannula and a CPAP mask, which is connected to a tube leading out of the scanner. The patient is covered with a white blanket and a blue patterned cloth. The MRI table is white and has a control panel with a red emergency stop button. The background is the interior of the MRI scanner, which is white and has some yellow markings.

Investigate and quantify any change in nasal geometry and blood flows induced by breathing at augmented pressures.

Participant Distribution

Table1: Distribution of Participant Details

Age	Gender	Ethnicity
22	Male	Asian
21	Male	Indian
53	Female	European
30	Male	European
29	Male	Middle Eastern
35	Female	Asian
33	Female	South American
26	Female	European

Table 2: Distribution of Participant Breathing Pressure.

Pressure (cm WG)	Male Participant Number	Female Participant Number
15	108	115
12	107	109
9	101	106
6	104	118



Measurement of Nasal Cycle Status



Table3: Distribution of Participant Nasal Airflow Details

Participant	Pre-Test MVV (litres/min)		Post-Test MVV (litres/min)		Patent Nasal Passage	Change in Nasal Cycle
	Right Nare	Left Nare	Right Nare	Left Nare		
101	not detected	10.3	not detected	12.6	Left	No
104	9.8	8.9	8.6	6.8	Right	No
106	11.4	10.5	11.1	Not detected	Right	No
107	4.6	8.0	6.3	6.7	Left	No
108	8.1	8.5	11.6	13.5	Left	No
109	6.9	5.7	7.8	7.1	Right	No
115	not detected	13.5	not detected	6.5	Left	No
118	9.5	7.4	8.2	7.7	Right	No

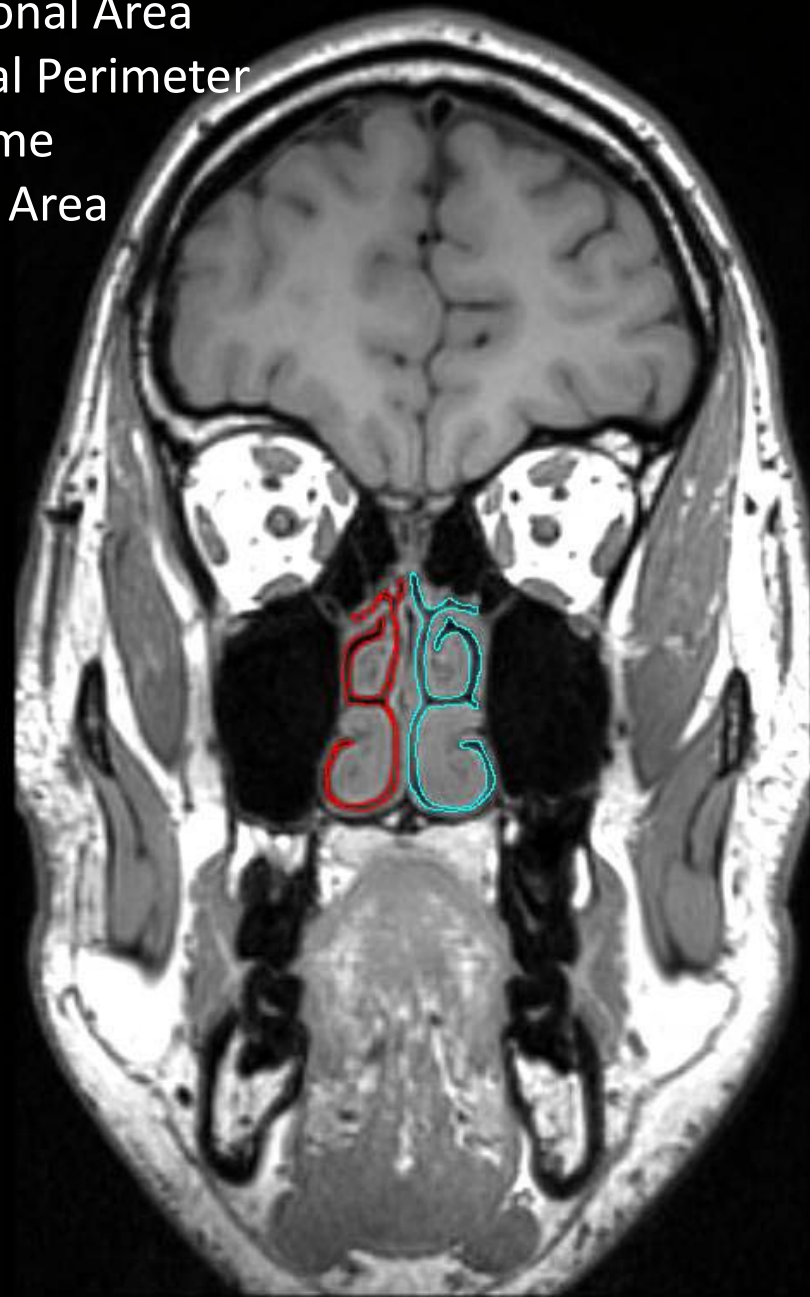
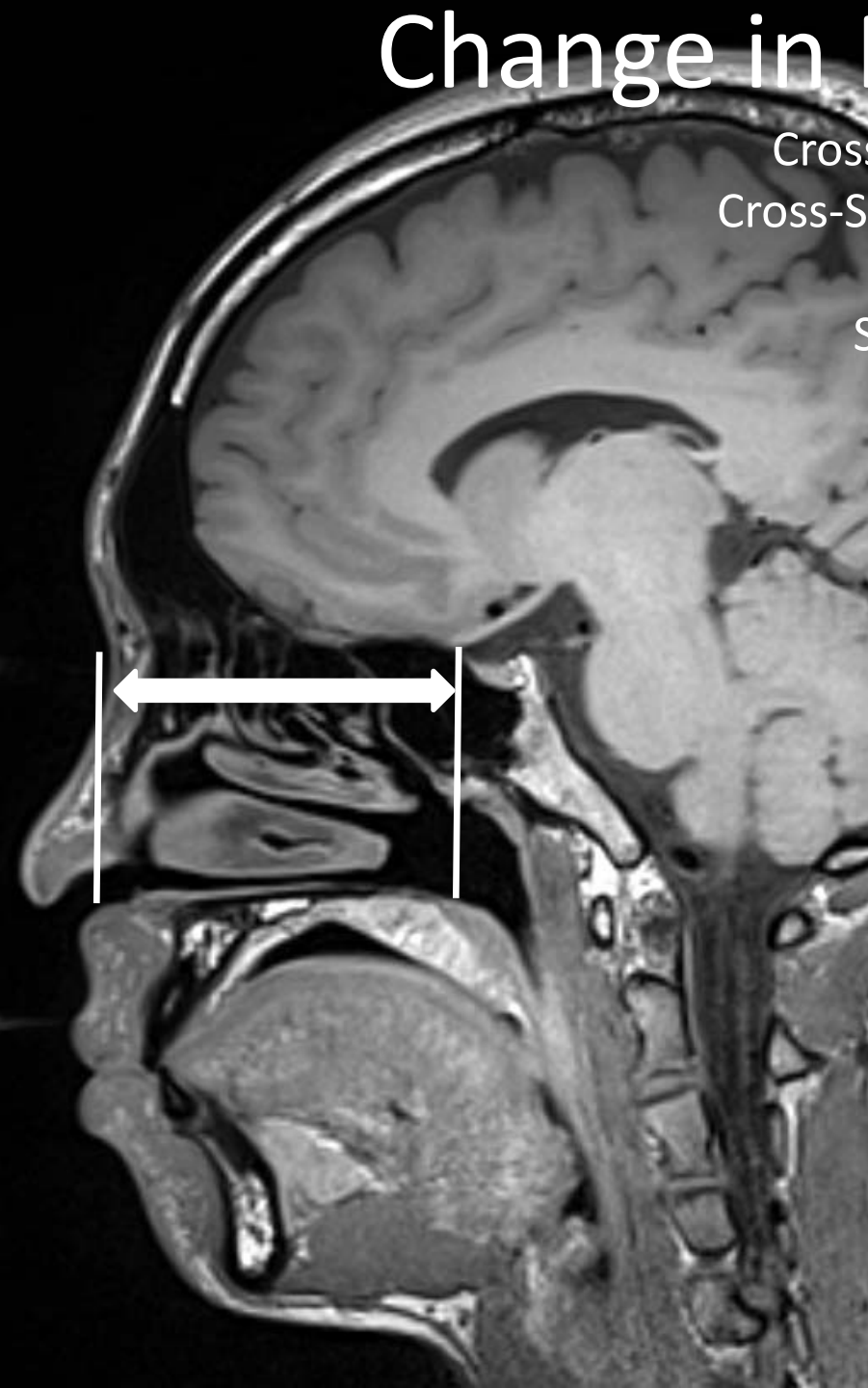
Change in Nasal Geometry

Cross-Sectional Area

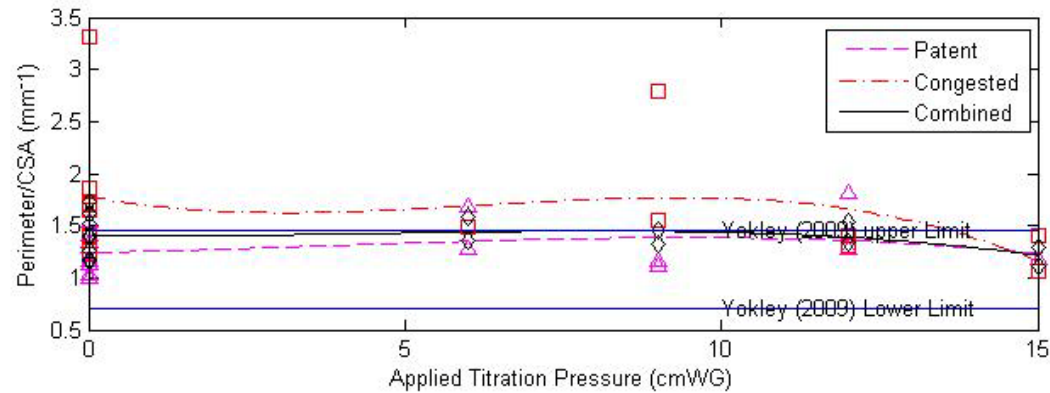
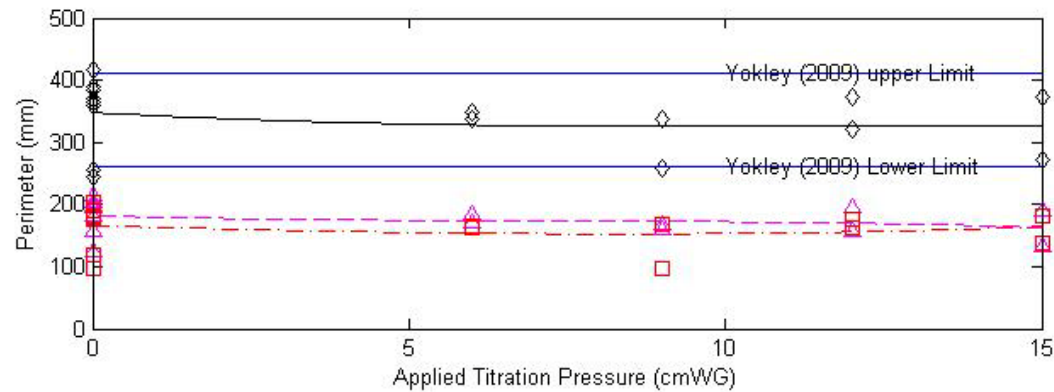
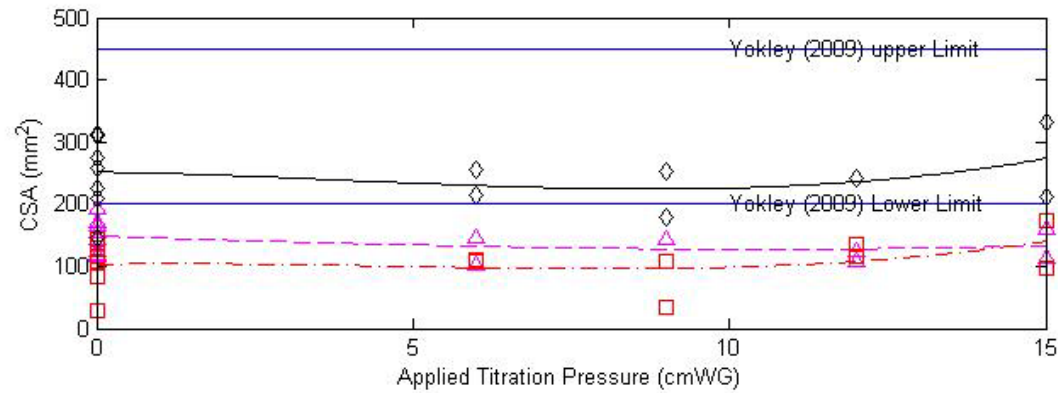
Cross-Sectional Perimeter

Volume

Surface Area

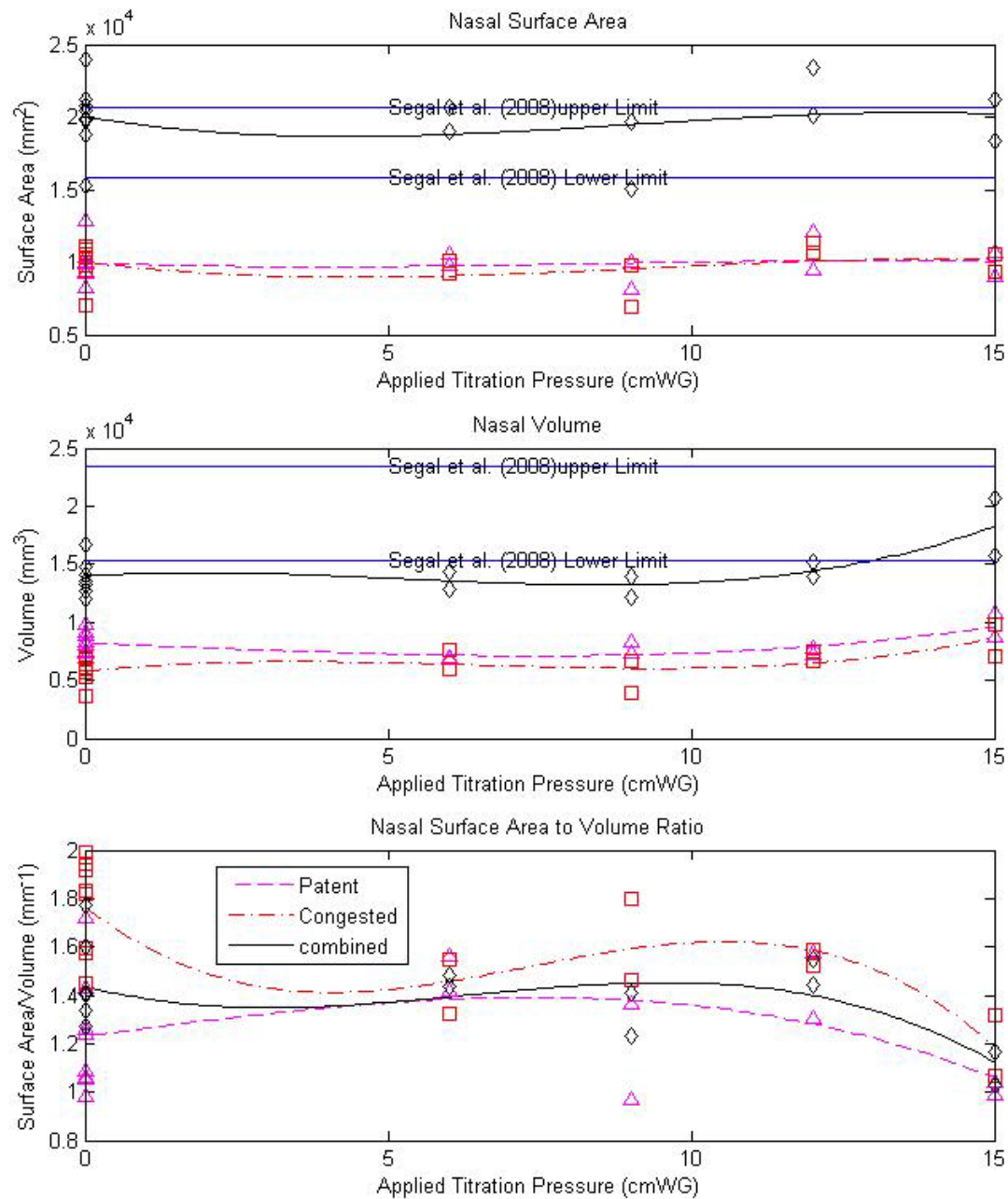


Mid-Nasal Air-conditioning Parameters



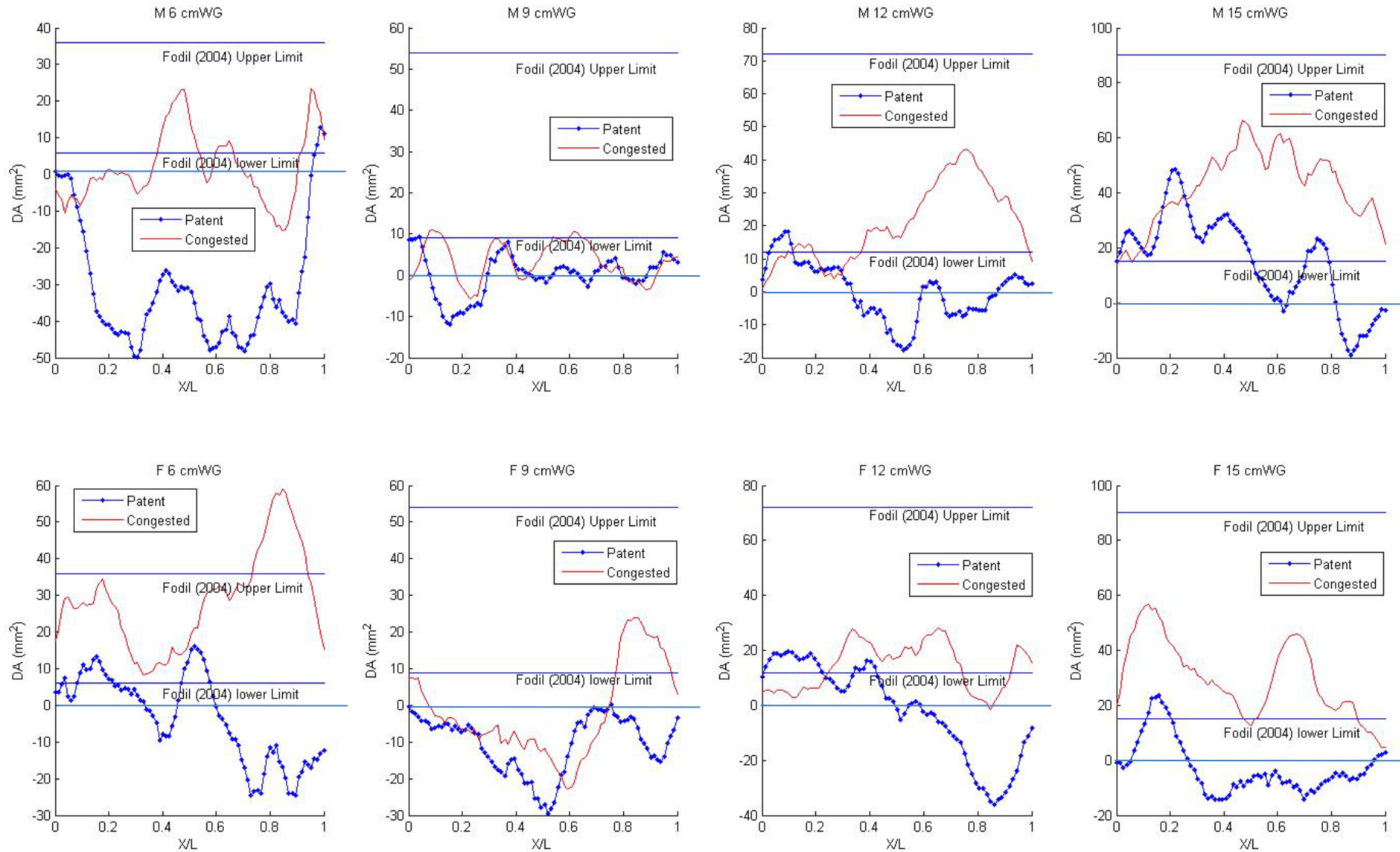
△ male, □ female, ◇ combined.

Overall Nasal Air-conditioning Parameters

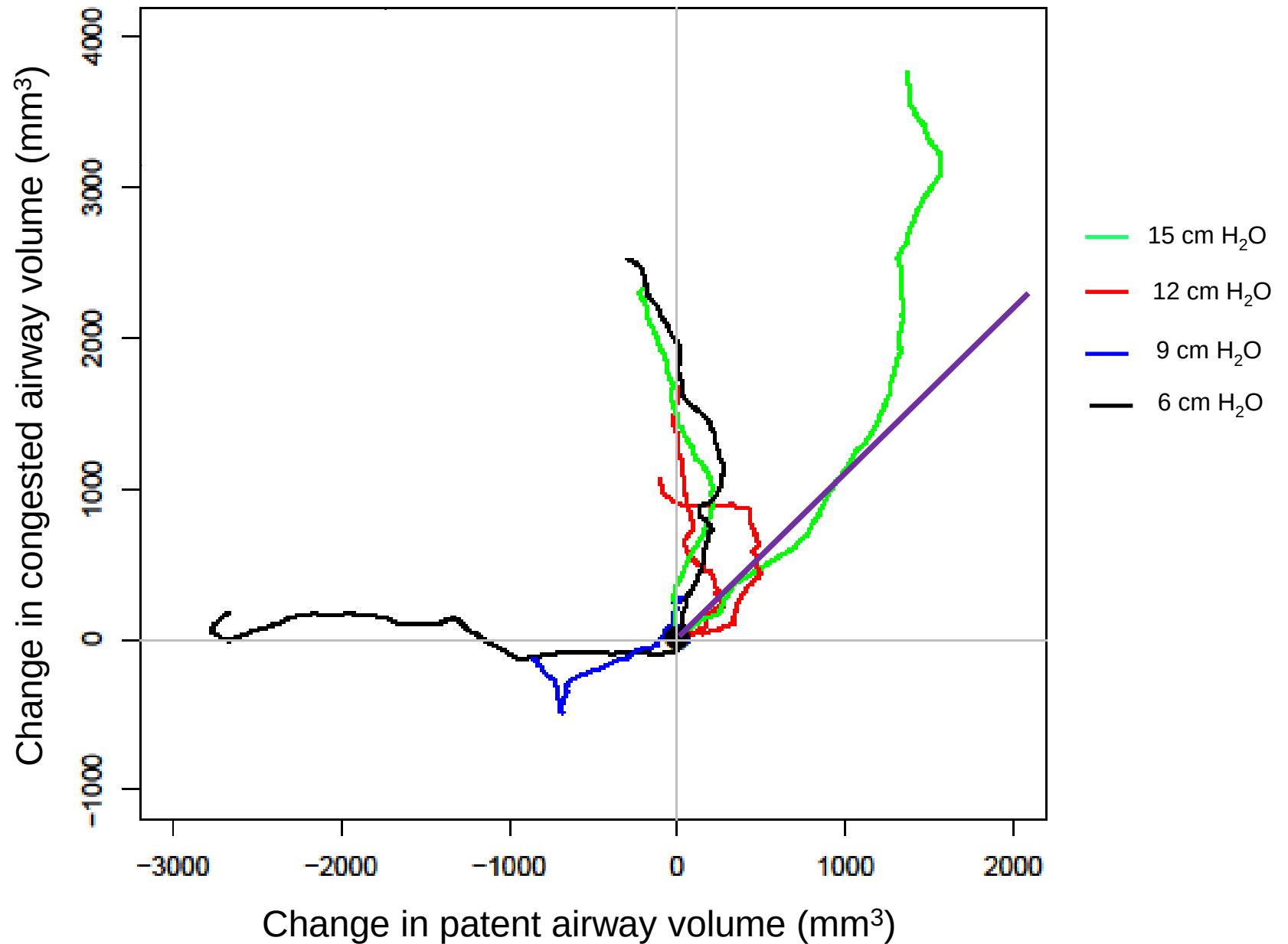


△ male, □ female, ◇ combined.

Change in CSA



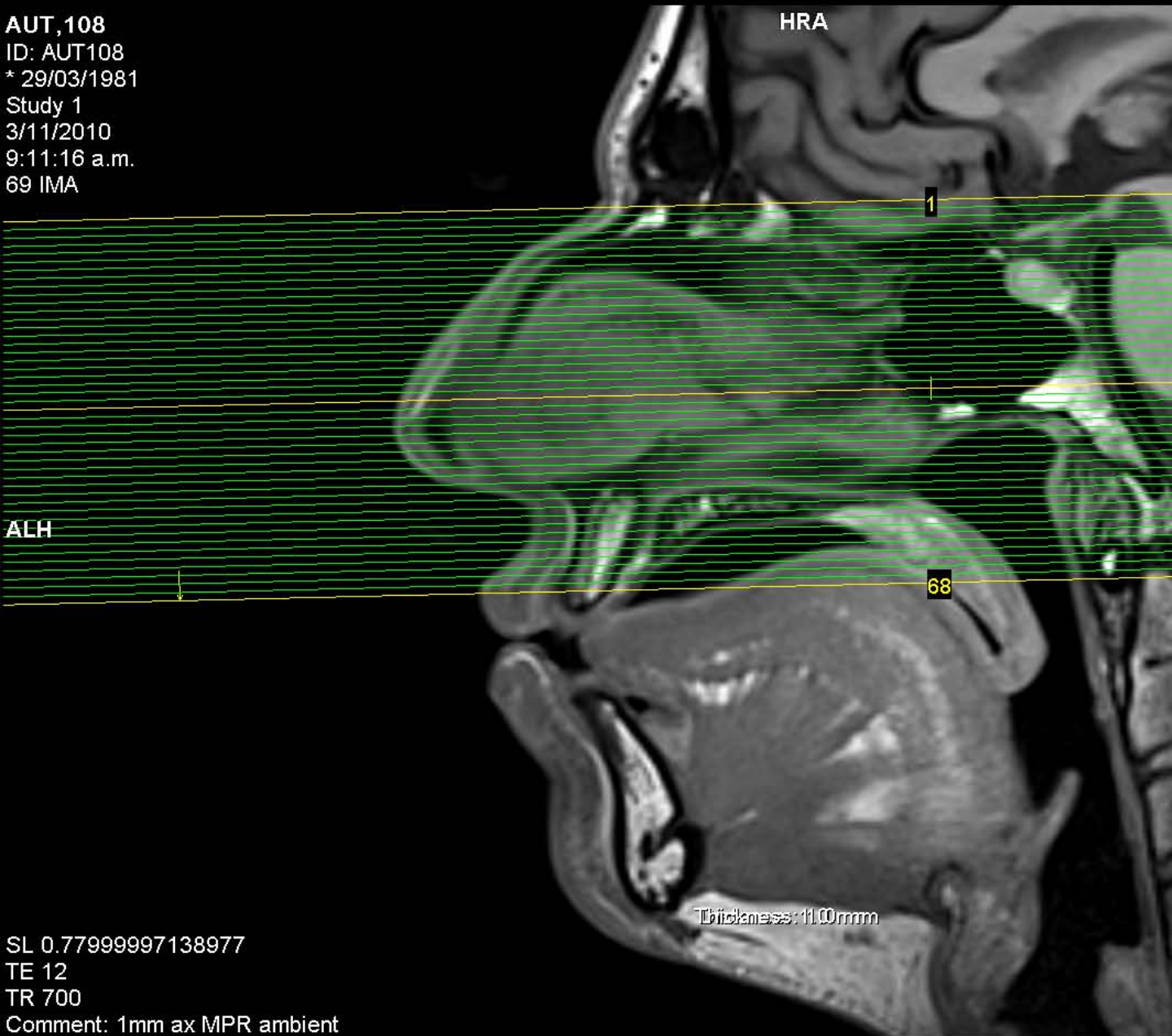
Distribution of nasal volume change.



Nasal Blood Flow - Arterial Spin Labelling

AUT,108
ID: AUT108
* 29/03/1981
Study 1
3/11/2010
9:11:16 a.m.
69 IMA

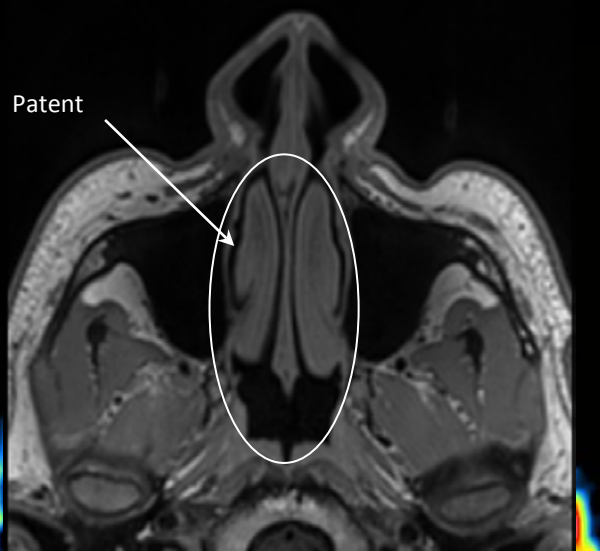
Centre for Advanced MRI
Skyra
HFS



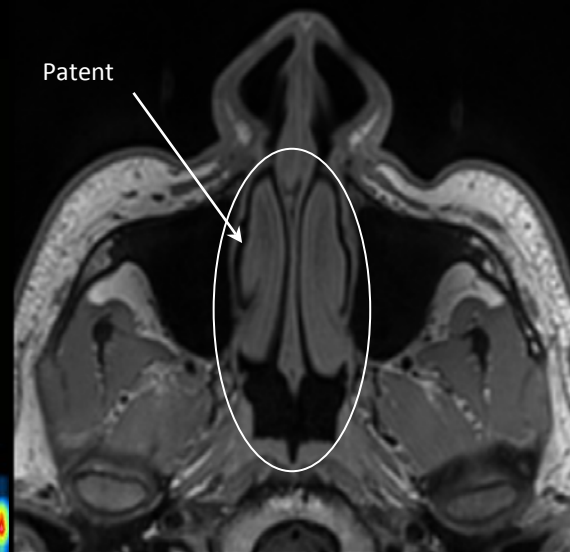
SL 0.77999997138977
TE 12
TR 700
Comment: 1mm ax MPR ambient



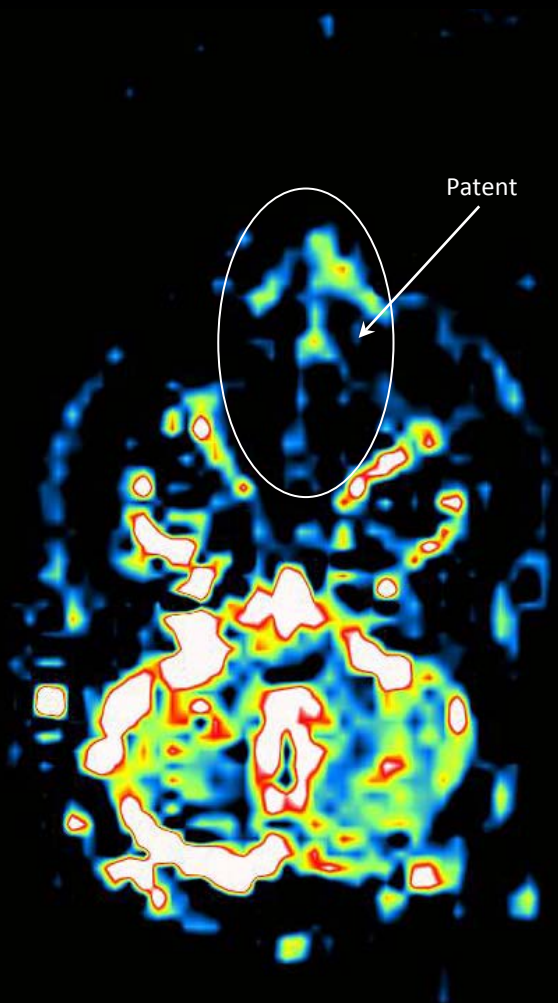
SP L0.8
FoV 181*181
320 *320
Sag>Cor(-3.6)>Tra(-1.8)
W: 506
C: 284



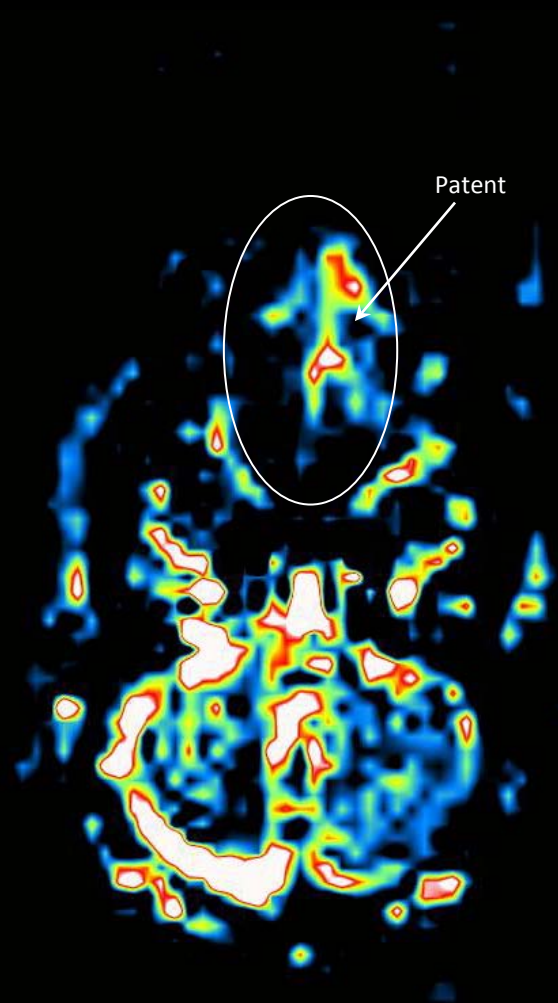
Male Ambient



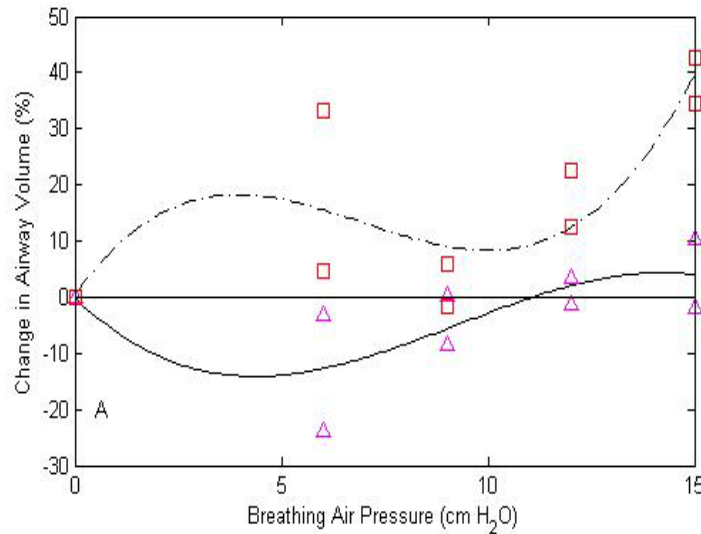
Male 15 cmWG



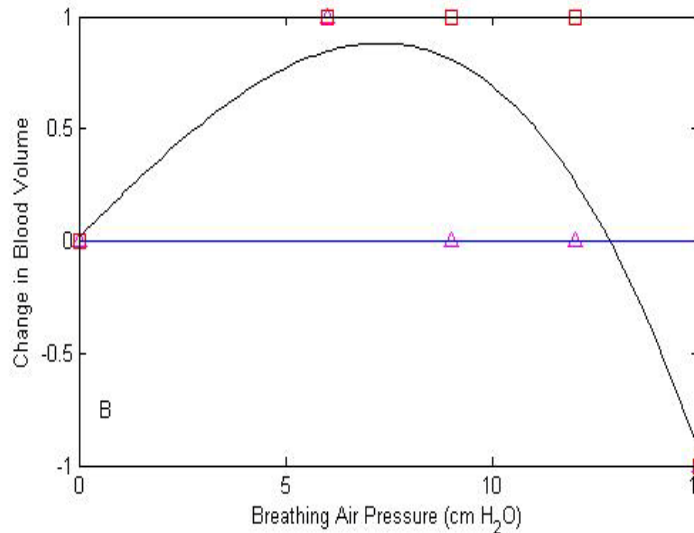
Male Ambient



Male 6 cmWG



Using a single sample two t-test, where null equals a mean of zero, pressure significantly changes ($p=0.01759$) the congested airway volume but does not significantly change ($p=0.452$) patent airway volume. There was no significance between male/female data.



Aylmer test for count data pressure causes a significant change in blood volume ($p=0.04762$)

Change in perfusion and volume. **(A)** Airway volume. **(B)** Patent airway inferior turbinate blood volume.

— patent airway - - - congested airway Δ male, $\square$ female.

Conclusions from MRI Investigation

1. Nasal Parameters of:

- Cross- Sectional Area
- Cross-Sectional Perimeter
- Volume
- Surface Area

are all within normal physiological limits over the range of augmented air-pressures considered.

- ## 2. Nasal blood flow through patent airway erectile tissue changes in response over the range of augmented breathing pressures considered.
- ## 3. Morphological nasal examination during augmented air-pressure breathing should consider the influence of patent and congested nasal erectile tissue active compliance characteristics.

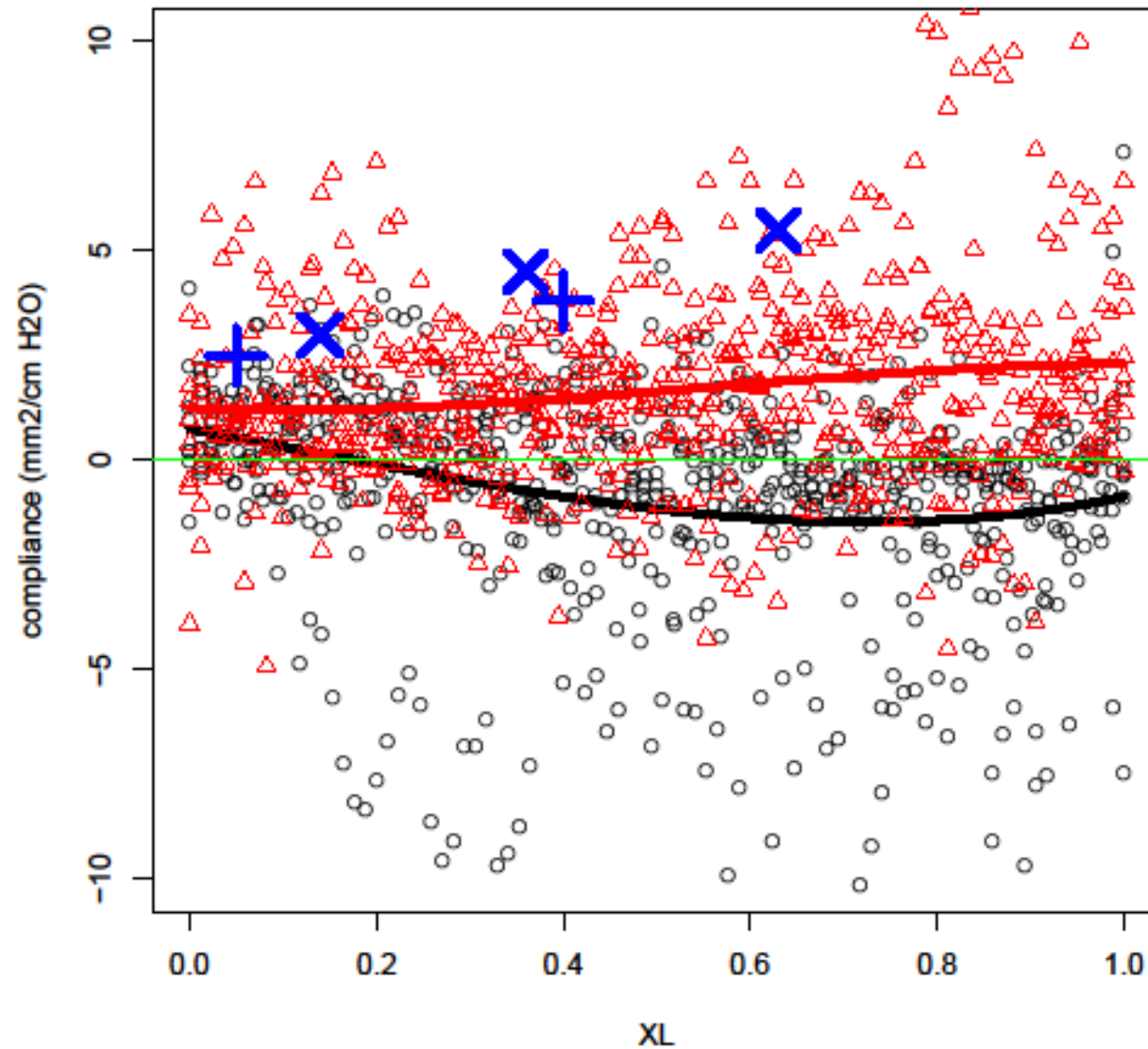
Acknowledgements

Assoc. Prof. Brett Cowan and Dr Beau Pontr , both from the Centre for Advanced MRI (CAMRI), University of Auckland.

Fisher & Paykel Healthcare

Institute to Biomedical Technologies (IBTec)

Erectile Tissue Compliance



Nasal compliance distribution along airway. $\triangle$ Congested $\square$ Patent.
 $+$ Kesavanathan et al. (1995), $\times$ (Brugel-Ribere et al., 2002).