

# Novel Chest Wall Motion Technology Can Detect the Success of Lung Volume Reduction Surgery via Endobronchial Valve Insertion in the Recovery Room.

Ghazi Elshafie<sup>1,2</sup>, Shayan Motamedi<sup>3</sup>, Rachel Wilson<sup>3</sup>, Richard Steyn<sup>1</sup>, Maninder Kalkat<sup>1</sup>, Eihab Bishay<sup>1</sup>, Pala Rajesh<sup>1</sup>, Babu Naidu<sup>1,2</sup>

1 Department of Thoracic Surgery, Heart of England NSH Foundation Trust, B9 5SS, Birmingham, UK

2 School of Clinical and Experimental Medicine, University of Birmingham, B15 2TT, UK

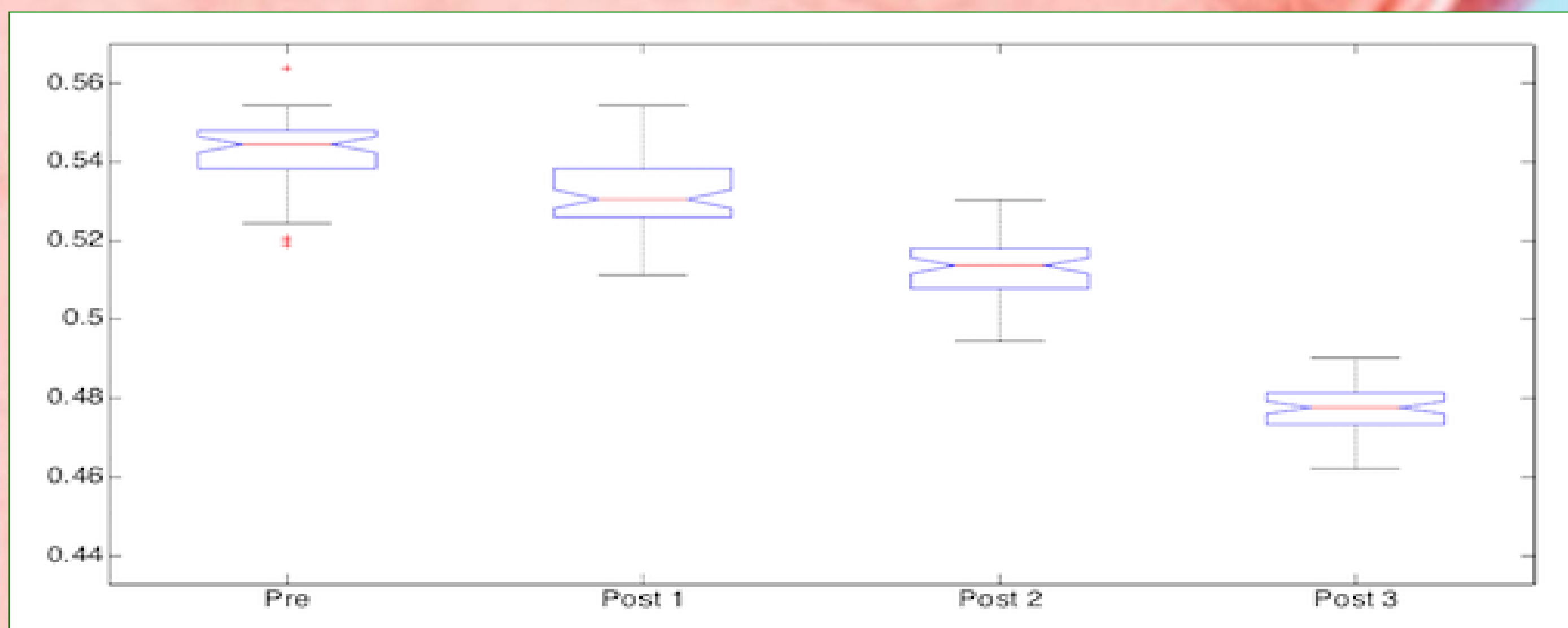
3 PneumaCare Limited, Cambridge, CB4 0WS, UK.

**OBJECTIVES:** Lung volume reduction surgery (LVRS) via endobronchial valves (EBV) insertion improves clinical outcomes and quality of life in selected patients with emphysema. The response to this intervention has been inconsistent because collateral ventilation prevents lobar atelectasis. Outcomes of this procedure are measured radiologically, but these radiological methods lack sensitivity and cannot identify non-responders immediately after surgery. Therefore, we evaluated the viability of using Structured Light Plethysmography (SLP), a novel portable device to measure success/failure of EBV insertion by measuring the lobar atelectasis affect on dynamic chest wall motion.

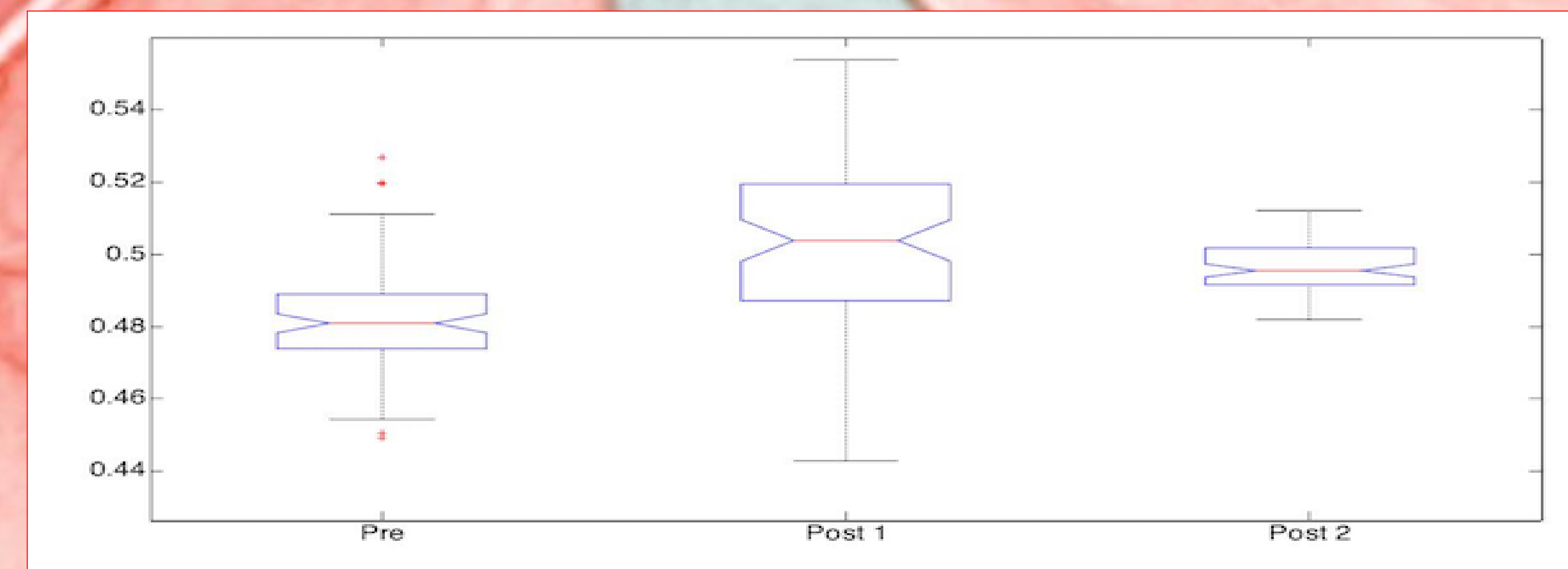
**METHODS:** The SLP device (Thora-3Di™, PneumaCare Ltd) measures both rib cage and abdominal motion using a grid of light which is simultaneously 'seen' by a digital vision system. Grid movement during breathing is analyzed and displayed in terms of regional thoraco-abdominal movement parameters as well as a 3D reconstruction. Measurements were made during quiet breathing, before and immediately after surgery and for up to 3 days post operatively.

**RESULTS:** Three male patients with COPD with a mean age of 70 (range from 60 to 75) years, underwent lung volume reduction surgery via unidirectional Zephyr EBVs, with a mean of 3 valves/patient (range from 1 to 5) (figure 1), and mean hospital stay of 3 days (range from 2 to 3 days). 100 % of all planned measurements could be performed, all without complications or discomfort to patients. Out of the three patients, one patient had a successful procedure. In this patient SLP detected a significant reduction in the chest motion of the operated side of the chest immediately after the operation in the recovery room, that was sustained during his subsequent in-hospital days from (55 +/- 0.99 % pre-op to 48 +/- 0.60 % at 2<sup>nd</sup> post operative day) (figure 1a) (P < 0.001) indicating the success of the procedure. This was mirrored by an improvement in his Borg breathless score from 7 to 0. In the other two patients SLP could detect a lesser degree of reduction in the motion of operated side of the chest after surgery, from 48 +/- 1.52 % to 49 +/- 0.77 % and from 53 +/- 0.54 % to 50 +/- 0.64 % (figure 1b) (P < 0.001) and that is mirrored in the CT scans performed at 1 month after surgery as well patients' Borg score.

**CONCLUSION:** SLP is a valuable tool for thoracic surgeons that can detect the success or failure of lung volume reduction surgery via EBV insertion immediately after surgery. Further studies are required to determine usefulness of the measure.



**Figure 1a:** shows the % contribution of the right chest to the total chest wall motion after a **successful** insertion of one EBV insertion in Right middle lobe. (Post 1 = Recovery room).



**Figure 1b:** shows the % contribution left chest to total chest wall motion after an **unsuccessful** insertion of 3 EBV in the left upper lobe. (Post 1 = Recovery room).