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REVOLUTIONISING MEDICINE - THE NEW FRONTIER

Comparative-experimental Study: Efficacy of Nebulisation Therapy Delivery For Tracheostomised Patients With Or Without Novel Mask Connector

Lim Jia Yan, Neo Soon Keow, Chandran Rajkumar, Qin Jing, Ma Chongyan, Vernon Chen Yi Liang, Tang Hongyan, Maxim Tan, Evangeline Peros

Changi General Hospital
SingHealth

Background

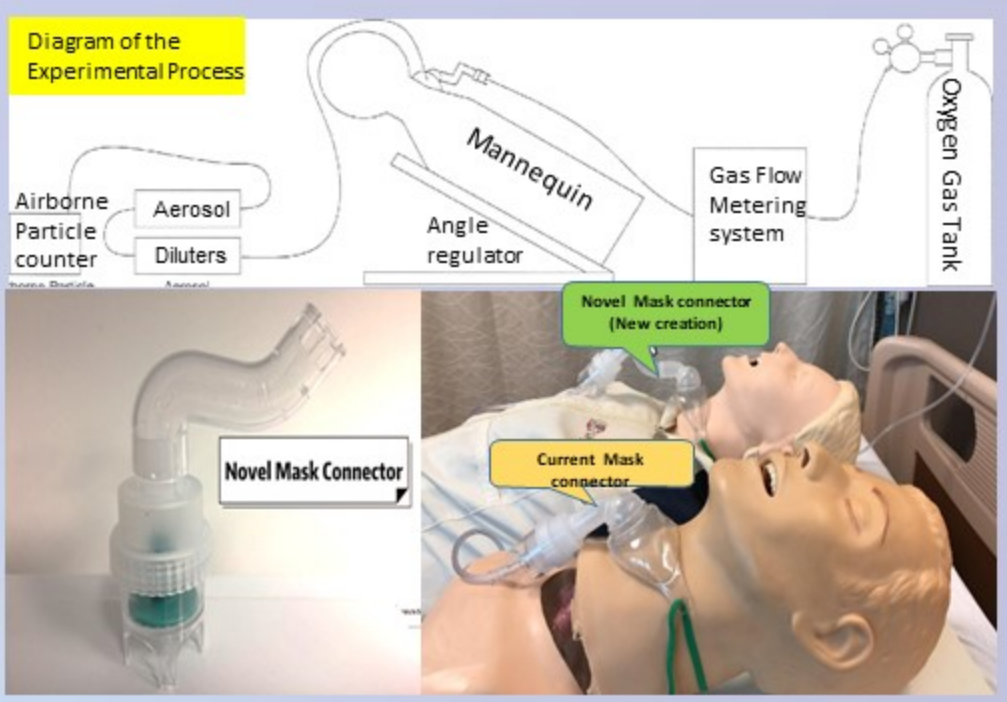
Tracheostomised patients undergo daily nebulisation treatment to alleviate airway and reduce thick secretion. Nurses constantly faced difficulty keeping the nebulisation chamber in an upright position for optimal misting. The suboptimal misting may potentially resulted to compromise treatment, blockage of tracheostomy tube and develop other complication. The team collaborated with counterparts from Changi General Hospital (CGH) Centre for Innovation (CFI) to design a Mask Connector that helps maintain the nebulisation chamber in the optimal angulation for effective medication delivery. The project team leveraged on CFI's quick prototyping capability using 3D Printing Technology and had made eight iterations before deriving with the final design.

Aims

The study aimed to test the efficacy of the Novel Mask Connector (NVM) in enhancing nebulisation therapy delivery for tracheostomized patients.

Methodology

Comparative-experimental was conducted in a controlled laboratory environment to study the efficacy of nebulization therapy delivery with and without NVM.
Mannequin is placed on the reclined surface of 15, 30 and 45 degree with an airborne particle counter placed at the throat of the mannequins to records particles of 3.0, 1.0 and 0.7micron sizes. Electronic gas flow meter regulate Oxygen at the flow rate at 6L/min to the neublisation chamber containing 3mls of normal saline (0.9%) to the mannequin for 5 minutes with 50 repetitions, at each angle for both with NVM and without NVM.
Residual volume is recorded based on the weight of the nebulisation chamber before and after each repetition.



Result

Particle Count

At 15 degrees at the end of 5 minutes, NVM yield higher amount of particle count for micron sizes of 3.0, 1.0 and 0.7 respectively and the results have strong statistical significance ($p<0.001$).

At 30-degree and 45-degree, and across all three time-points, i.e., end of 1 min, 3 mins and 5mins, the NVM produced more particle count than without for particle sizes of 1.0 µm and 3.0 µm.

The greatest difference was observed at the end of 1 min for 45-degree (0.33 x 108 /m3, 95% CI: 8.65 x 108 /m3 to 17.27 x 108 /m3, $p=0.01$).

Residual volume

At the end of 5 minutes, the mean difference for the residual volume in the NVM vs without NVM groups was marginal. At 30-degree, the residual volume in the tests conducted using without NVM was significantly lesser than NVM, with p-value <0.001 and a difference of 0.32g (0.32mls)

Residual volume: Descriptive for data collected

Degree	Variable	Mean (SD)	Min – max
15	Before	25.39 (0.24)	24.51 – 25.92
	After	24.17 (0.27)	23.16 – 24.87
	Residual (before-after)	1.22 (0.16)	0.69 – 1.85
30	Before	25.5 (0.25)	24.3 - 26.01
	After	23.96 (0.32)	22.89 - 24.6
	Residual (before-after)	1.53 (0.32)	0.35 - 2.53
45	Before	24.77 (0.37)	24.12 - 25.72
	After	22.85 (0.63)	22.08 - 24.31
	Residual (before-after)	1.92 (0.37)	1.10 - 2.74

Residual volume: Residual volume between the group

Degree	Experiment (n=50)	Control (n=50)	Difference (95% CI) (Experiment – control)	P value
15 Mean (SD) Min – max	1.19 (0.16) 0.70 – 1.85	1.24 (0.16) 0.69 – 1.84	-0.04 (-0.11, 0.02)	0.160
30 Mean (SD) Min – max	1.37 (0.27) 0.35 – 1.88	1.69 (0.29) 1.15 – 2.53	-0.32 (-0.43, -0.21)	<0.001
45 Mean (SD) Min – max	1.85 (0.43) 1.10 – 2.68	1.99 (0.29) 1.32 – 2.74	-0.14 (-0.29, 0.002)	0.054

Conclusion:

The usage of NVM enhanced the efficacy of nebulization delivery for patient with tracheostomy. The team has filed a patent application for the NVM. Moving forward, the team aims for production of NVM for clinical trial.

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