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Title : EVALUATION AND CLINICAL APPLICATION OF A NEW CPAP DEVICE

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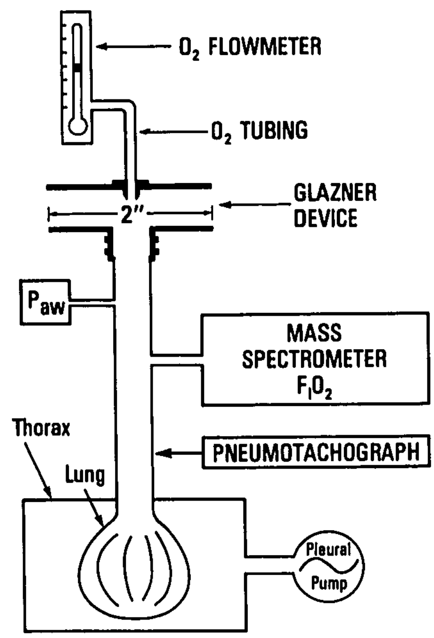
Introduction: In this report we describe and evaluate a new CPAP device (Glazner device). The device consists of a disposable T-piece through which a hole is drilled to accomodate a small plastic nozzle directed towards the patient connection. CPAP is accomplished by supplying a continuous flow of oxygen to the nozzle from an oxygen flowmeter-oxygen humidifier system. The patient exhales against the oncoming flow of oxygen emerging from the nozzle, and the level of CPAP is determined by the oxygen flow rate.

Methods: A bag (lung) in box (thorax) mechanical lung model was used which had in-line airway pressure (P_{aw}), F_IO_2 and flow rate sensors (see figure). Inflation/deflation was accomplished by a pleural pump with a constant 600 ml tidal volume. Inspiratory/expiratory gas (lung) flow rate (ratio 1:1) was varied by altering the pleural pump speed. CPAP level was changed by altering the oxygen nozzle flow rate. The experimental sequence consisted of measuring the P_{aw} (EE=end expiratory, I=inspiration, E=expiration) generated by the CPAP device using two different sized oxygen flow nozzles (2.2 and 0.6 mm), oxygen (nozzle) flow rates 5-30 L/min and gas (lung) flow rates 20-100 L/min.

Results: Our results show that for both sized oxygen flow nozzles, increases in the oxygen nozzle flow rate produced increases in the EE level of CPAP; however, the smaller sized oxygen flow nozzle produced higher levels of CPAP for any given oxygen nozzle flow rate (table 1). With either sized oxygen nozzle, as gas (lung) flow rate was increased, inspiratory and expiratory pressures increased. At any given oxygen (nozzle) and gas (lung) flow rate the inspiratory decrease and the expiratory increase in P_{aw} were greater with the smaller sized oxygen flow nozzle than with the larger. We have additionally measured CPAP levels in spontaneously breathing intubated patients and found the device to deliver 5, 7, 10, 14 cm H_2O CPAP when the oxygen flow through the 2.2 mm nozzle size was 8, 10, 14, and 20 L/min respectively.

Discussion: We have described and functionally evaluated a new device which provides clinically useful levels of CPAP using clinically relevant oxygen and gas flow rates. Since we found that P_{aw} did not vary a great deal during inspiration and expiration at various patient gas flow rates, we conclude that the work of breathing should not be adversely affected when using this device. The device is lightweight, inexpensive, easily assembled, not gravity dependent, and not dependent on values. The device is well suited for the following situations: (1) providing CPAP to spontaneously breathing intubated patients in the ICU or recovery room; (2) transport of CPAP dependent patients. The device can be adapted for patients who also require mechanical ventilation.



CPAP, Torr

2.2 mm Nozzle

Oxygen L/min		10			15			20			30		
	CPAP Moment	EE	I	E	EE	I	E	EE	I	E	EE	I	E
Gas L/min	20	8	8	9	9	8	9	11	10	12	14	13	15
	40	8	7	9	9	7	9	11	9	12	14	10	15
	60	8	6	9	9	6	10	11	7	13	14	9	16
	80	8	5	10	9	5	10	11	6	13	14	6	17
	100	8	4	12	9	3	12	11	5	15	14	5	19

0.6 mm Nozzle

Oxygen L/min		5			10			15		
	CPAP Moment	EE	I	E	EE	I	E	EE	I	E
Gas L/min	20	2	1	3	9	7	11	15	13	17
	40	2	0	3	9	5	13	15	11	20
	60	2	-1	4	8	3	14	15	8	23
	80	1	-3	4	8	1	15			
	100	0	-5	6	7	-1	16			