

# Assessment of Ventilatory Muscle Strength Using a Pressure Manometer

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## SUMMARY

This article describes a simplified method of assessing ventilatory muscle strength using a newly designed pressure meter. Measurement of maximal static respiratory pressures has been reported to be the most direct method of assessing the ventilatory strength.

Discussion is based on the value of quantifying ventilatory muscle strength using this method.

## OPSOMMING

Hierdie artikel beskryf 'n vereenvoudigde metode om asemhaling spiersterkte vas te stel met die gebruik van 'n drukmeter wat onlangs ontwerp is. Daar is gesê dat meting van maksimale statiese respiratoriese drukings is die mees direk metode om asemhaling spiersterkte vas te stel.

Die waarde van die kwantifisering van asemhaling spiersterkte met die gebruik van hierdie metode, word bespreek.

Weakness of the ventilatory muscles is difficult to recognise clinically yet has important clinical implications.

The forced vital capacity may be used to register ventilatory muscle strength in some clinical situations in which there is a dramatic alteration in the ventilatory muscle function e.g. the Guillain Barré Syndrome.

Monitoring of forced vital capacity alone is however not adequate to register subtle changes in ventilatory muscle strength resulting from muscle fatigue in chronic obstructive pulmonary disease for example.

One reliable method of assessing the function of the ventilatory muscles is to measure their strength using static respiratory pressures.<sup>1,2,3,4</sup>

This is a sensitive method of measuring the strength of ventilatory muscles in a co-operative and motivated patient. Maximal static inspiratory pressure is measured when the inspiratory muscles are optimally lengthened following a complete expiration to residual volume. Similarly maximum static expiratory pressures are measured at total lung capacity when the expiratory muscles are in their most advantageous position.

## THE METHOD OF MEASURING MAXIMUM INSPIRATORY PRESSURES (MIPS) AND MAXIMUM EXPIRATORY PRESSURES (MEPS) AT KING EDWARD VIII HOSPITAL

### The Pressure Manometer

This instrument was designed with the aid of an engineering firm and is described as the MIPS and MEPS Manometer. The instrument consists of a diaphragm gauge connected to an outlet pipe. The capacity of measurement ranges from zero to 250 centimetres of water for both expiratory and inspiratory mouth pressures.

### The technique of measurement

The measurement is done with the subject seated. After a maximum inspiration the mouth-piece is placed well into the mouth. The lips are pursed to stabilise the mouth-piece. MEPS is measured when the subject expires as forcibly and as quickly as possible. The



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Table 1. Ventilatory Muscle Strength in a Group of Tetraplegic Patients

Age	Level of lesion	Tetraplegic patients		Age-matched normal individuals	
		MIPS $\text{cm}/\text{H}_2\text{O}$	MEPS $\text{cm}/\text{H}_2\text{O}$	MIPS $\text{cm}/\text{H}_2\text{O}$	MEPS $\text{cm}/\text{H}_2\text{O}$
23	C4/5	28	+20	105	115
28	C4	-60	+43	85	100
53	C4/5	-65	+50	-90	110
55	C3/4	-40	+28	70	65
23	C4/5	-90	+65	105	115

Table 2. Progressive Monitoring of MIPS and MEPS in a patient with Guillain Barré Syndrome

Date	Age	Patient	MIPS $\text{cm}/\text{H}_2\text{O}$	Patient	MEPS $\text{cm}/\text{H}_2\text{O}$
			Mean MIPS of group of age and height matched individuals		Means MEPS of age-matched normal individuals
21.1.85	21	-21	-65	-26	+75
31.1.85	21	-26	65	+26	+75
15.3.85	21	-57	65	+55	+75



subject is asked to hold the maximum expiratory effort for one second. The mean of three trials is recorded.

The M.I.P.S. is measured near residual volume after a maximal expiration with the lips sealed tightly around the outer circumference of the mouth-piece. The subject is asked to inspire as forcibly as possible.

The manometer has been in use for approximately six months. Every effort has been made to exclude errors in measurement techniques.

Much time was spent in choosing a suitable mouth-piece as it was found that the type of mouth-piece used could influence the performance.

The conventional disposable cardboard mouth-piece with an inside diameter of 3 centimetres was found to be a most suitable one.

#### VENTILATORY MUSCLE STRENGTH MEASUREMENTS IN SOME CLINICAL SITUATIONS

Comparison of mean respiratory pressures between

tetraplegic patients with normal age-matched subjects demonstrates a serious compromise in the expiratory muscle function in the tetraplegic patient. This is obviously explained by the fact that the level of the lesion does spare some inspiratory function, but results in marked reduction in expiratory force.

The resultant decrease in expiratory force and flow leads to insufficient dynamic compression of the airways during the explosive phase of cough. This could have serious implications on bronchial hygiene if adequate respiratory care is not instituted.

There was approximately a sixty per cent reduction in the patient's MIPS and MEPS values when compared to those of the mean MIPS and MEPS values of a group of normal individuals in the same age group. This patient had a very weak cough.

The improvement in ventilatory muscle strength was found to be consistent with the overall improvement in motor function.

#### CONCLUSION

The measurement of ventilatory muscle strength is a new facet in the overall management of the patient with respiratory involvement.

It is a simple method of quantifying ventilatory muscle strength and has proved very useful in a number of clinical situations.

#### References

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