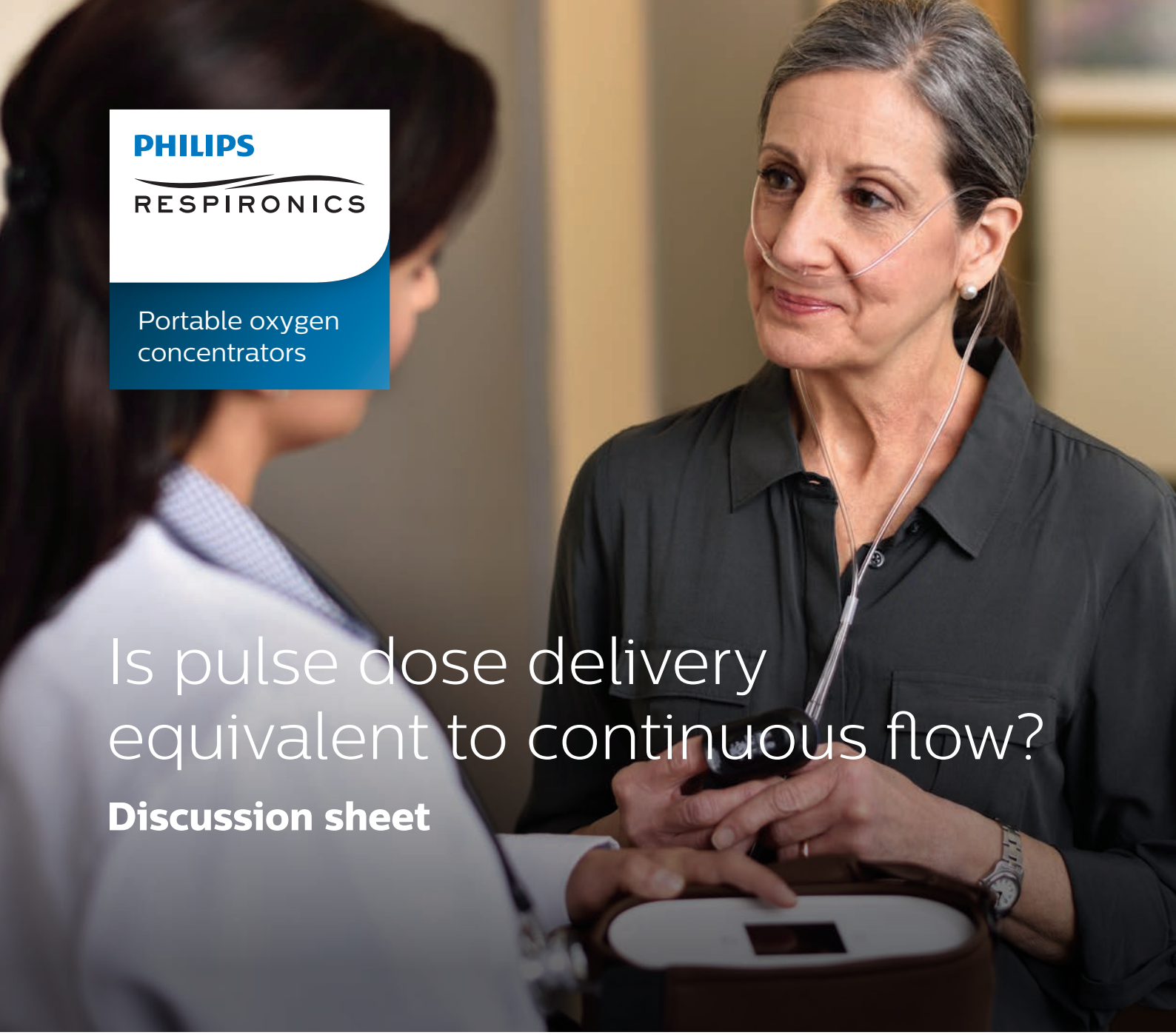

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RESPIRONICS

Portable oxygen concentrators

Is pulse dose delivery equivalent to continuous flow?

Discussion sheet

Long-term oxygen therapy (LTOT) in the home often follows the model of “non-delivery LTOT” where oxygen concentrator technology is used to provide both stationary and ambulatory oxygen. With the non-delivery model, oxygen supply companies reduce the need to make repeat and costly home deliveries to replenish depleted gaseous or liquid oxygen contents which is used during ambulation or away from the stationary system. Hypoxemic chronic obstructive pulmonary disease (COPD) patients that require continuous, uninterrupted O_2 are no longer tied to their home to receive treatment.

One of the ambulatory options that combined with a stationary concentrator, in the non-delivery model is to utilize a portable oxygen concentrator (POC). POCs can incorporate the pulse dose delivery of oxygen with a preset volume or bolus of O_2 administered at some point during the inspiratory phase of the patient’s breathing cycle. Pulse dose devices provide an intermittent flow (IF) of O_2 versus the continuous flow (CF) that is supplied from a concentrator or oxygen tank. There are 2 classifications of POCs, those that only operate in the pulse dose/IF mode or those that are dual mode and can operate in either pulse dose/IF or CF modes. An IF device is quantified in milliliters (mL) per breath, whereas the CF device is in liters per minute (L/min).[1]

For well over 70 years, continuous flow devices have been designed and calibrated to deliver flow in L/min. Devices that are pulse dose cannot use the L/min designation because they do not deliver continuous flow. As an alternative, pulse dose devices are calibrated in milliliters per breath, which is known as a fixed bolus volume or milliliters per minute, known as a fixed minute volume.

Fixed bolus volume: a predetermined bolus size is calculated for each POC setting and regardless of breathing rate the same size will be delivered with each breath.

Fixed minute volume: a predetermined volume of oxygen is produced for each POC setting over the course of a minute and since the amount of O_2 produced for each minute remains steady the amount of O_2 will be different for each breath.[2]

Numerical settings on intermittent flow and continuous flow devices: Several studies have been published to demonstrate that pulse dose methods from either a portable oxygen concentrator or an oxygen conserving device can safely deliver oxygen to the COPD patient, but that the IF setting is not equivalent to the CF settings due to the differences in the design and calibration of the methods of delivery. There is widely held misconception that the numerical settings on the IF and CF products are equivalent, such that a setting of 1 is equal to a 1 L/min. This is not the case and can lead to incorrect O_2 therapy.[1]

Chatburn et al studied nocturnal pulse dose as compared to continuous flow. The average CF setting was 2 L/min whereas the IF setting was 3. Although, 20% of the patients did have settings from both devices that matched each other, it was not expected that this would be consistent amongst all users.[3] In other studies; data has concluded that equivalency does not exist between the POCs and CF. Therefore, the numerical settings on the POC should be interpreted as an indication of increased fixed bolus volume or fixed minute volume. Some manufacturers promote within their promotional materials that the POC setting number is the same as L/min even though it has been refuted in the scientific literature. This can cause clinicians and patients to believe that they are receiving a higher delivered O_2 flow than in reality.[4]

Conclusion

Due to the discrepancy between the numerical values of IF and CF, it has been recommended that when using a portable concentrator or pulse dose apparatus that the patient should be tested with a pulse oximeter to confirm that the device's ability to maintain adequate oxygenation[1] Furthermore, the patients should be tested on the actual units that they will be utilizing and under all conditions of use.[1,5]

References:

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