# Respiratory care of using non-invasive positive pressure ventilation for patient with acute respiratory failure

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## ABSTRACT

Non-invasive positive pressure ventilation is commonly used when a patient has acute respiratory failure or hypoxemia. However, long-term use can result in redness and pressure injuries on the nose bridge, cheeks, and bony prominences.

Clinical cases using non-invasive ventilation were transferred from another hospital, and significant improvements in leakage and oxygenation were observed after changing the cushion.

Upon on-site evaluation, significant improvements in the patient's respiratory condition were noted after changing the cushion.

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## INTRODUCTION

In clinical settings, Non-invasive positive pressure ventilation is commonly used when a patient has acute respiratory failure or hypoxemia. This involves delivering positive pressure ventilation through a mask interface rather than an endotracheal tube or tracheostomy. However, long-term use can result in redness and pressure injuries on the nose bridge, cheeks, and bony prominences.

Preventive measures often involve using a cushion for skin pressure relief to lessen cheek skin pressure and help avoid complications from pressure injuries. Yet, if the pillow does not fit snugly on the face or its density is insufficient, it can lead to inadequate oxygen levels and tidal volume in the patient, resulting in shortness of breath and compromised oxygenation.

Clinical cases using non-invasive ventilation were transferred from another hospital, and significant improvements in leakage and oxygenation were observed after changing the cushion.

## METHODS AND MATERIALS

The patient was transferred to the emergency room in August 2023 and was evaluated by respiratory therapist on-site. Due to respiratory failure, they were put on non-invasive positive-pressure ventilation. Clinical symptoms included shortness of breath, tachycardia, and desaturation. The reason for these symptoms was identified, and the cushion was changed; respiratory parameters such as oxygen saturation, breathing rate, heartbeat, and tidal volume were monitored before and 30 minutes after the change.

## RESULTS

Upon on-site evaluation, significant improvements in the patient's respiratory condition were noted after changing the cushion【figure1A & figure1B】, values are shown as mean ± SD.

Comparative measurements showed substantial differences in tidal volume(TV) 182.90±84.32 vs. 413.90±27.38 ml ($p$<0.0001), minute volume(MV) 3.76±1.51 vs. 8.12±0.86 liter/minute ($p$<0.0001), respiratory rate(RR) 32±1.94 vs 25.8±1.87 times/min ($p$=0.0002), leak volume 80.10±17.97 vs 37.30±7.44 ml/minute ($p$<0.0001), and oxygen saturation($SPO_2$) 93.80±1.75 vs 98.10±0.74 % ($p$<0.0001)【table 1】.

## GRAPHS AND TABLES

Table1:

| parameter | before | | after | | t | *p*-value |
|---|---|---|---|---|---|---|
| | mean | ±SD | mean | ±SD | | |
| **tidal volume (ml)** | 182.90 | 84.32 | 413.9 | 27.38 | -8.21 | <0.0001 |
| **minute volume (liter/min)** | 3.76 | 1.51 | 8.12 | 0.86 | 6.90 | <0.0001 |
| **respiratory rate (times)** | 32.00 | 1.94 | 25.80 | 1.87 | -6.15 | 0.0002 |
| **Leak volume (ml)** | 80.10 | 17.97 | 37.30 | 7.44 | -7.96 | <0.0001 |
| **oxygen saturation (%)** | 93.80 | 1.75 | 98.1 | 0.74 | 6.79 | <0.0001 |

Figure 1A:

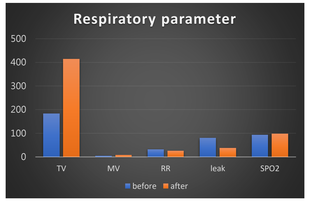
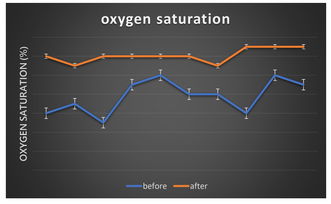



Figure 1B:




## DISCUSSION

Various cushion products are available to prevent pressure injuries in patients using non-invasive positive pressure ventilation. However, different materials may lead to significant leakage during ventilation, reducing blood oxygen levels and compromising patient safety. These events do not result in harm but warrant careful evaluation when choosing cushion products in the future.

## CONCLUSIONS

Patient safety is fundamental to healthcare quality. Operational protocols must incorporate factors related to patient safety to prevent unsafe events and avoid their recurrence, thereby enhancing the quality of patient care.

## REFERENCES

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