Protecting Every Breath and Improving Patient Comfort
S9™, VPAP™, Stellar™ and ResMed Interfaces

Michael Madison
Respiratory Care SBU
June 26, 2013
Today’s Topics

• ResMed’s S9™ Series
  – Climate Control
  – The Next Level of Quiet
  – Patient Comfort and Compliance

• S9 VPAP™ ST-A
  – Patient Synchrony - Vsync and TiControl™
  – Volume Support - iVAPS, and iBR

• Stellar™ 150

• VPAP™ COPD

• ResMed’s Mask Portfolio
Climate Control
What is **Climate Control** on S9?

The **Climate Control** system controls the temperature *and* humidity levels of the air the patient *breathes*.
3 Levels to Successful Humidification

- Humidity
- Temperature
- Rainout Control
3 Key Elements of Humidification Delivery

- **Humidity**
  - Control Absolute Humidity (AH)

- **Temperature**
  - Control Mask Temperature

- **Rainout Protection**
  - Control Relative Humidity
Sensing Elements of **Climate Control**

- Ambient Temperature Sensor & Humidity Sensor
- Heater Plate Sensor
- Flow Sensor
- Mask Temperature Sensor
H5i™ Humidification Control

• The H5i now has added intelligence to help deliver constant humidity to minimize rainout complaints during standard humidification
  – Humidification control looks at Ambient Humidity and adjusts the output
  – Prevents rainout into the tubing
  – Heat is also adjusted for flow rates
    • Less flow – less heat needed
    • Plate may feel cooler than H4i

• The H4i would heat the water to a given setting regardless of ambient humidity
  – For a given setting you could get varying humidification output based upon ambient conditions
H5i™ Example

- For example: Dry Environment

\[
\text{Ambient Humidity} + \text{Humidifier Output} = \text{Total Water Delivered}
\]

\[
4 \text{ mg/L} + 14 \text{ mg/L} = 18 \text{ mg/L}
\]
The Next Level of Quiet
Taking Quiet to the Next Level

• Original Easy-Breathe motor lowered noise levels with the S8 Series II devices.

• *Enhanced* Easy-Breathe motor takes quiet to the next level!
Taking Quiet to the Next Level

Noise can be broken down into:

- **Radiated** noise
- **Conducted** noise
Radiated Noise

- Radiated noise levels in S9 are the same as S8 II (24±2 dBA)*

What are the benefits of low radiated noise?
- Patient and bed partner **comfort**. Device is no louder than normal breathing.

* ISO 17510-2002
• Some examples of conducted noise
  – Tin can telephone
  – Stethoscopes
  – Car without a muffler
Conducted Noise

• Conducted noise levels in S9 are 78% less than S8 II!

What are the benefits of low conducted noise?
• Better patient comfort
• Less vibration through the cheekbones
• Lower noise at the mask leads to a peaceful night’s sleep
Patient Comfort and Compliance
Allowing You to Be Involved in Your Care

- Colored LCD Screen
- Sleep Quality Report
- Mask Fit Feature
- Climate Control
User Interface – Information Menu

• Sleep Quality
User Interface – Mask Fit

- Mask Fit - Good
User Interface – Mask Fit

- Mask Fit - Adjust
Overcoming Therapy Challenges in the Home with the S9 VPAP ST-A
S9 VPAP ST-A Product Overview

• Modes: CPAP, S, ST, T, PAC & iVAPPS

• Intended use: (Respiratory insufficiency & OSA)
  – 30 cm H$_2$O IPAP
  – User-settable alarms
  – Climate Control
  – 50 bpm backup rates
  – TiControl features
What Sets the S9 VPAP ST-A Apart?

• iVAPS
• Climate Control
• High performance — pressures to 30 cm H$_2$O for the full range of NIV patients
ResMed’s Home NIV Solutions

- Optimized for patients with respiratory insufficiency
  - TiControl™ customizable to disease type
  - Vsync leak compensation

- iVAPS: intelligent Volume-Assured Pressure Support
  - Targets alveolar ventilation
  - Intelligent backup rate (iBR)
  - Adjusting pressure support
• TiControl customizes therapy to patient needs

• Ti Max and Ti Min can:
  – Ensure minimum breath length
  – Protect exhalation time

• Works with Vsync to ensure patient–ventilator synchrony
Rise Time: How Quickly Pressure Increases EPAP to IPAP

Problem: Patient describes “Pressure is too STRONG!”

Solution: Increase rise time
Problem: Patient’s inspiratory effort is weak (i.e. restrictive disease)/can’t sustain adequate inspiration

Solution: Best option – Increase/prolong Ti Min
**TiControl™ = Trigger & Cycle Sensitivities**

Adjustable Trigger Sensitivity

<table>
<thead>
<tr>
<th>Level</th>
<th>Sensitivity</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Quick to trigger</td>
<td>2.4 L/min</td>
</tr>
<tr>
<td>High</td>
<td>More sensitive</td>
<td>4 L/min</td>
</tr>
<tr>
<td>Med</td>
<td>Default</td>
<td>6 L/min</td>
</tr>
<tr>
<td>Low</td>
<td>Less sensitive</td>
<td>10 L/min</td>
</tr>
<tr>
<td>Very Low</td>
<td>Slow to trigger</td>
<td>15 L/min</td>
</tr>
</tbody>
</table>

Adjustable Cycle Sensitivity

<table>
<thead>
<tr>
<th>Level</th>
<th>Sensitivity</th>
<th>% of peak flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>Quick to cycle</td>
<td>50%</td>
</tr>
<tr>
<td>High</td>
<td>More sensitive</td>
<td>35%</td>
</tr>
<tr>
<td>Med</td>
<td>Default</td>
<td>25%</td>
</tr>
<tr>
<td>Low</td>
<td>Less sensitive</td>
<td>15%</td>
</tr>
<tr>
<td>Very Low</td>
<td>Slow to cycle</td>
<td>8%</td>
</tr>
</tbody>
</table>
Targets Alveolar Ventilation

- iVAPS targets alveolar ventilation accounting for anatomical dead space
- Adjusts pressure support to meet target

![Diagram of pressure over time, showing target alveolar ventilation and actual alveolar ventilation]
Who is the S9 VPAP ST-A with iVAPS Suitable for?

Neuromuscular disease and restrictive conditions

Obesity hypoventilation

Chronic obstructive pulmonary disease

Studies show that men with any history of military service are at a nearly 60% greater risk of amyotrophic lateral sclerosis than men who did not serve in the military.¹

¹ ALS Association. ALS in the military: unexpected consequences of military service, May 2011
Continuing Care from the Hospital to Home with the Stellar 150
Stellar 150 — Powerful Enough for the Hospital, Portable Enough for the Home

High value in a portable, simplified solution

- Internal battery
- Real-time monitoring
- Customizable programs for day/night needs
- Excellence in ventilator–patient synchrony
- Optional integrated SpO₂ and FiO₂ monitoring
Mobility reduces therapy disruption

• Internal battery provides 2 hours of therapy to get through rehab or move down to the lab

• Adding an external battery can add another 8 hours (you can combine 2 external batteries for up to 16 hours)

• Mobility bag secures the ventilator while still providing access to screen and knobs
Comprehensive Monitoring

Real-time monitoring

• Flow and pressure curves can be viewed simultaneously
• Key parameters are visible
  – I:E ratio
  – Minute ventilation
  – Respiratory rate
  – Leak
  – Tidal volume
  – FiO₂ (when connected)
Optional Preset Customizable Programs

Customizable programs for patients who need different levels of support at different times

- Perfect for patients who have different needs during rest and exercise or during day and night

- Preset programs reduce the time required to change each setting individually
Pathology Defaults

Preset options include settings for the following disease states:

- Obstructive lung disease
- Restrictive lung disease
- Obesity hypoventilation
- Normal lung mechanics
Superior noninvasive ventilation to manage transition from hospital to home

• Easy to use
• Small yet powerful
• Comprehensive monitoring
• Effective on a wide population

Making quality of care easy
Introducing ResMed’s Home NIV Solution for COPD: VPAP™ COPD
The COPD Challenge

In 2012, more than a million COPD patients experienced an acute exacerbation that resulted in a hospitalization\(^1\), and up to this point, NIV has often not been a part of the treatment of these patients post-discharge.

VPAP™ COPD

- First and only EO470 device indicated for COPD
  - Settings optimized for COPD
- Pressure capability up to 30 cm $H_2O$
- ClimateLine$^{MAX}$ Oxy – integrated oxygen entrainment support
- ECO – monitor patients in the crucial 30 days post-discharge
- Alarms
ResMed’s Comprehensive Mask Product Lines

Full Face Masks Are Ideal for:

- Patients who experience mouth leak
- Patients with deviated septum
- Patients with seasonal allergies
Quattro FX Technology

**Enhanced Spring Air™ technology**
- Wider at sensitive nasal bridge area
- Membrane inflates over nasal bridge instead of stretching over it

**Dual-wall cushion**
- Thick inner cushion provides stability
- Thin outer membrane enhances seal

**No forehead support**
- Patient has a clearer field of vision
- Less obtrusive, lighter weight and less complex

**Tension-reducing headgear**
- Contours on head for stable seal
- Sits above the back of the neck
Introduction to Nasal Masks

**Enduring design**
- First type of seal used to treat OSA; still popular today
- Seals around the nose for gentle and comfortable seal

**Cushion options**
- Choice of conventional silicone, ActiveCell™ technology or gel cushions
- Interchangeable Activa LT and SoftGel cushions on same frame (ConvertAble Series)
Mirage FX and Mirage FX for Her Technology

**Spring Air cushion**
- Inner wall cutaway at nasal bridge to allow softer texture in the outer wall
- Reduces soreness and irritation

**Durable frame**
- Durable, flexible and lightweight material
- No headgear clips for easy connection/disconnection

**SoftEdge headgear**
- Flexible and breathable

**Squeeze-tab elbow**
- New materials eliminate squeaking
- Less parts

**In-molded vents**
- Disperse air quietly and gently
Introduction to Nasal Pillows

**Minimal design**
- Reinforces sense of freedom
- Unprecedented softness, simplicity and stability

**Flexible**
- Fluid form follows facial contours and user movements
- Promotes early therapy acceptance

**Intuitive, virtually instant fitting**
- Stable performance, even at high pressures
Swift FX, Swift FX for Her and Swift FX Bella Technology

**Patented dual-wall nasal pillows**
- Thin outer membrane inflates and conforms to nares to provide a soft robust seal
- Thick inner membrane provides softer structural support and stability

**Flexible pillow base**
- Enables the nasal pillows to move multiple directions vertically and laterally

**Spring-flex lightweight tubing**
- A revolutionary new tube that stretches 178% of its length
- Tube has a strong retention to swivel and minimizes tube drag, which results in seal stability and less leaks

**Headgear**
- Low-profile design that covers only a small part of the face and head
- Designed with minimal parts and few adjustment points, which minimizes the risk of hair getting caught in headgear and is easy to adjust
• VPAP ST-A, Stellar and VPAP COPD offer multiple features aimed at improving patient outcomes.

• Asynchrony commonly results in negative patient outcomes. ResMed technology can overcome most asynchrony challenges.

• ResMed offers a wide range of masks to optimize fit and comfort.