

An Introduction to the AirPal® RAMP® (Rapid Airway Management Positioner)

A Background on AirPal® Patient Transfer Systems, Inc:

AirPal® Patient Transfer Systems, Inc. formed in 1984 to develop a marketable air-assisted lateral patient transfer device. The device developed by AirPal® has an underside that is perforated for air release. The device is attached to an air supply which forces a constant flow of high volume/low pressure air which causes the device to inflate a semi-rigid surface for patient transfers. Upon inflation excess air escapes out through the perforations on the bottom of the device. A frictionless surface, literally a "cushion" of air, is formed upon which the patient is moved almost effortlessly. Robert Weedling, AirPal's® Chairman, is a listed holder of the original patent. The company is headquartered and manufactures in Pennsylvania.

The first prototypes of the AirPal® Platform were introduced in 1984, and the line has had four major generations. In 1986 AirPal® introduced a version of the Platform with enhanced patient cradling and stability. The second generation AirPal® Platform utilized a system of internal latitudinal stringers to produce the cradling and stability features. The second generation AirPal® Platform formed the mainstay of the Airpal® product line for many years while incremental improvements were made and the product line expanded with specialized versions of the AirPal® Platform. Additions to the product line included multiple widths and half pads. The third generation AirPal® Platform saw rapid development of several product enhancements and two patented innovations. These product enhancements were made beginning in 2003. The third generation AirPal® Platform has a patented ergonomic handle system and an integrated patented extended liner. Other major product enhancements include the use of specialized medical fabrics and double-layered patient surfaces to enhance patient skin management. Integral stabilization bands increased the strength and durability of the product line and assist in correcting off-centered patients during inflation, as well as putting the patient in a prone position. The fourth generation of products made their debut in early 2007 with the announcement of the RAMP® technology (Rapid Airway Management Positioner).

The RAMP® technology integrates airway management with safe patient handling. The technology is patented worldwide. The RAMP® technology allows caregivers to position a patient in the optimal "ear to sternal notch" position regardless of patient habitus. The application of patient positioning for airway management has long been regarded as paramount to procedural success. The "ear to sternal notch" position is considered optimal for intubation/extubation, maximizing airway patency, improving gas exchange with BVM (Bag Valve Mask) ventilation, and reducing the work of breathing, especially for obese and morbidly obese patients. The RAMP® system for airway management is integrated with an AirPal® Platform that allows the device to travel with and assist caregivers in transferring the patient. The RAMP® provides benefits cross departmentally, offering a "continuum of care" for both airway management and patient transfer/positioning.

What is the RAMP® ?

The RAMP® is an air-assisted patient positioning device for airway management. The technology works through a system of independently adjustable inflatable surfaces. Two air chambers are used to adjust a patient's position into alignment with the airway axes. The airway axes are optimally aligned when a

patient can be put into an "ear to sternal notch" position, which is achieved when the patient is placed onto their back and the chest is elevated or "ramped" at about 15 to 20 degrees. The head is then positioned relative to the chest by aligning the opening to the ear canal horizontally to the sternal notch. The AirPal® RAMP® uses a specialized Air Controller to adjust patients. Because adjustments can be made incrementally and precisely through filling and releasing air in the chambers, the RAMP® is suitable for all patients regardless of habitus. Once placed under the patient the RAMP® can be used to acquire the "ear to sternal notch" position on demand repeatedly, and be controlled by a single operator. The RAMP's® lower air chamber is used to elevate the patient's chest and creates an adjustable incline surface when inflated. The RAMP's® upper air chamber or "Intubation Pillow" provides adjustment to the position of the patient's head relative to the chest. The RAMP® can be used to maintain the patient's position for extended periods of time (beneficial in recovery) and, because it is integrated with an AirPal® Platform, patients can be transferred while kept in position; maximizing the management of the airway without interruption. The RAMP's® ability to maintain patient position when transferred is significant because it results in a lengthening of the Safe Apnea Period (the period of time until critical O2 desaturation).

Common Applications:

1. Pre-oxygenation prior to anesthesia/intubation
2. Airway axes alignment – assists in tracheal tube insertion/intubation procedures, improved POGO scores and glottic exposure
3. Extubation – assists in airway tube removal and minimizes threat of tissue trauma
4. Assists to maximize airway patency with static alignment of airway axes
5. Reduced work of breathing with chest wall excursion and reduced internal organ pressures upon the diaphragm
6. BVM (bag valve mask) ventilation – increased gas exchange
7. Recovery – maximizes airway patency and facilitates patient position for emergency airway re-insertion
8. Offers compliance to Safe Patient Handling policies and procedures (bed to stretcher and "ramping")

The "Difficult Airway:"

"The principal adverse outcomes associated with the difficult airway include (but are not limited to) death, brain injury, cardiopulmonary arrest, unnecessary tracheostomy, airway trauma, and damage to teeth."

**Practice Guidelines for Management of the Difficult Airway
Anesthesiology, V 98, No 5, May 2003**

Although inspection of the oral cavity can provide some indication of a "perceived" difficult airway there is no standard definition in available literature. A difficult airway is more often discovered after multiple direct laryngoscopies and maneuvers are attempted. Difficult airways are the result of a complex interaction between patient factors (physiology), the skills of the caregiver, the setting and patient positioning. Decidedly, once the caregiver is committed to an intubation attempt there is little room to retreat and place the patient into the "ear to sternal notch" position to improve their chance of success.

While new technologies such as video laryngoscopes have advanced the ability for visualization, they do not replicate the positive effects of positioning the patient in the "ear to sternal notch" position. While placing a patient into the "ear to sternal notch" position is beneficial, it remains non-standard due to the ad-hoc nature of placing linens behind the patient, time restraints and the inability to move, transfer, or

reposition a patient once a "ramp" is established. The AirPal® RAMP® changes the application and accepted protocols of patient positioning for airway management by standardizing the "ramping" procedure into an automatic, time efficient and replicable procedure requiring just one operator. This also leads to patient habitus (obesity) no longer needing to be the major impetus for using the "ramping" technique to place a patient in the "ear to sternal notch" position, because patients of any BMI can benefit from and be accommodated by the RAMP® technology.

Importance of Patient Positioning for Airway Management:

"Increasing head elevation and laryngoscopy angle (neck flexion) significantly improves POGO scores during laryngoscopy..."

ANNALS OF EMERGENCY MEDICINE 41:3 MARCH 2003

Head-Elevated Laryngoscopy Position: Improving Laryngeal Exposure During Laryngoscopy by Increasing Head Elevation

Richard M. Levitan, MD; C. Crawford Mechem, MD; E. Andrew Ochroch, MD; Frances S. Shofer, PhD; Judd E. Hollander, MD

"Ideal BVM positioning is obtained by aligning the patient's external auditory meatus with the sternal notch (ear-to-sternal notch position). Ear-to-sternal notch positioning provides better alignment of the oropharyngeal axes than does the traditional "sniffing" positioning."

ACEP News September 2008

Focus On - Bag-Valve Mask Ventilation

Ann M. Weiss, MD, and Michael Lutes, MD

"Every obstetric airway should be considered a difficult airway. The practitioner should anticipate difficult anatomy and rapid desaturation. Every obstetric patient undergoing emergency intubation should be pre-oxygenated as time permits. Patients should be positioned using the ear-to-sternal notch method..."

ACEP News July 2007

Focus On: Emergency Airway Management in the Pregnant Patient

Michael Lutes, MD and Amy Slawter, MD

"RESULTS: The "ramped" position improved the laryngeal view when compared to a standard "sniff" position, and this difference was statistically significant (P=0.037). CONCLUSION: The "ramped" position is superior to the standard "sniff" position for direct laryngoscopy in morbidly obese patients."

Obesity Surgery. November 1, 2004

Laryngoscopy and morbid obesity: a comparison of the "sniff" and "ramped" positions

Jeremy S. Collins, MB ChB; Harry J.M. Lemmens, MD, PhD; Jay B. Brodsky, MD; John G. Brock-Utne, MD, PhD; Richard M. Levitan, MD

"Some of the pitfalls of BVM ventilation are inadequate position..."

FDNY-EMS CME Journal 2009_J01 "Bag-Valve Mask Ventilation"

Doug Isaacs, M.D.

Associate Medical Director

FDNY Bureau of Training

Use of the RAMP® System over an Extended Period:

The RAMP® and integrated Platform are manufactured with specialized medical fabrics. The fabrics have a built-in, anti-microbial system (Sure-Chek®) pioneered by our materials supplier, Herculite® Inc. Herculite® medical fabrics are not "run-of-the-mill" coated nylon fabrics like those found on other products, but highly tested and engineered materials selected for their specific characteristics. The main body of the AirPal® RAMP® is constructed from Linea 70®; specifically designed for pressure management surfaces. AirPal® utilizes a double-layered system for the patient surface. The top patient surface is constructed from Sure-Chek Fusion III®.

The double-layered patient surface provides multiple benefits. The second top layer bridges seams and provides a smooth even surface to enhance the pressure management features of the materials. The effect of the two fabrics (one on top of the other) protects skin from shear as the two surfaces can slide against each other. The Sure-Check Fusion III[®] fabric was designed to achieve low interface pressures and the fabric itself has a cushioning effect. The top patient surface of Sure-Check Fusion III[®] has balanced stretch characteristics (both directions) engineered into it, which reduces skin shear effects and aids in the cushioning effect. The end result is a device that can be left under a patient for extended periods of time. In fact, customers routinely keep patients on top of the RAMP[®] for nearly their entire stay. Use of the RAMP[®] system will not contribute to skin management issues, since the fabrics conform to pressure management surfaces. Additionally, as opposed to using linens to "ramp" a patient, the AirPal[®] RAMP[®] offers a smooth regular surface that minimizes pressure points. This is an important aspect of the product because utilization of the RAMP[®] system can provide a continuum of care throughout the patient's stay.

General Overview of RAMP[®] Operation:

Prior to surgery or other procedures, the RAMP[®] should be positioned under the patient. Caregivers can place the RAMP[®] under a physically dependent patient using a log-rolling technique, similar to changing out a patient's linens while they remain in bed. Prior to any transfer the patient safety straps are required to be attached to secure the patient. The patient transfer capability can be used at any point once the patient is on top of the RAMP[®] system; even after the patient has been "ramped."

Although protocols may vary between facilities and with the nature of the surgery, the emergency, or the patient's medical condition, basic operation of the RAMP[®] system is straightforward, easy to use and requires only minimal caregiver instruction. The RAMP[®] system utilizes hospital supplied air or nitrogen as an inflation source (an AirPal Air Supply is used separately for transfer). The RAMP[®] Air Controller is directly connected to the hospital's air supply and then controls inflation of the two air chambers via dial selector and the attached air supply hoses. A "push button" located on the underside of the AirPal[®] Air Controller regulates the flow of air for inflation purposes. A second "push button" located on the top of the AirPal[®] Air Controller regulates the escape of air from the RAMP[®]. The Air Controller protects from over inflation with self resetting blow off valves located within the body of the Air Controller. Connections to the RAMP[®] itself are accomplished with a set of quick connect couplers. The couplers are self-sealing when disconnected, so the RAMP[®] system can remain inflated without connection to the AirPal[®] Air Controller.

The AirPal[®] RAMP[®] in Use:

For many patients, establishing and maintaining an airway is a routine procedure. Studies have established that the "ear to sternal notch" position is optimal for airway management, but it is often overlooked or dispensed with altogether due to time constraints, non-standard procedures and the ad-hoc method of stacking bulky and often unstable stacks of linens. Additionally, once a patient is "ramped" to the "ear to sternal notch" position they will have to be repositioned each time they are moved. The fact is that "ramping" a patient is cumbersome, time consuming and directly contradicts the instinct to make every second count; especially in emergency medicine.

The opposite is true with the AirPal[®] RAMP[®]. The RAMP[®] solves patient positioning problems for airway management by automating and standardizing the process. With the RAMP[®], patients can be positioned and adjusted on demand while requiring only a single operator. Positioning a patient with the RAMP[®]

can be achieved in seven seconds, on average. When the patient requires transfer to a bed or operating table the integrated AirPal® Platform can be utilized while the patient remains in the "ear to sternal notch" position; maximizing the patient's airway patency, reducing the work of breathing and improving the exchange of gasses with BVM (bag valve mask) ventilation, all of which contribute to a lengthening of the safe apnea period. Patients who go into code will benefit from the RAMP's® ability to rapidly deflate with built-in "dump valves," while an integrated "code board slot" allows easy insertion of a code board properly aligned to the patient's chest. The code board slot is made from the same nylon-based fabric used in the RAMP®. The fabric allows the code board to easily "slide" in place, even with the heaviest of patients. Stabilized or post surgical patients will benefit from the RAMP's® ability to transfer the patient into a recovery/ICU bed and maintain or place the patient in optimal position for airway management; especially in those instances where an airway needs to be re-established on an emergency basis.

Benefits of RAMP® Use:

- ***Pre-Oxygenation:*** Prior to anesthesia/intubation, it is common protocol to pre-oxygenate a patient. The RAMP® can be used to maximize the effectiveness of O2 saturation in the patient through patient positioning. Placing a patient in the "ear to sternal notch" position will maximize airway patency through alignment of the airway axes, and reduce the work of breathing through chest wall excursion and reduced internal organ pressures on the diaphragm. The resulting increase in exchange of gasses within the lungs improves the efficiency of pre-oxygenating a patient to saturation. The RAMP® system makes the use of patient positioning for pre-oxygenation practical and time efficient.
- ***Safe Patient Transfer and Positioning:*** Clinical trials concluded that a patient can be transferred from a stretcher to an OR Table, positioned on the OR Table and then "ramped" into the optimum "ear to sternal notch" position in under one minute. Although the efficiency of the RAMP® system is impressive, another important benefit is the ability to achieve this level of efficiency while remaining compliant with a facility's policies for Safe Patient Handling. The RAMP® is integrated with an AirPal® Platform, an air-assisted lateral patient transfer device, so bed/stretcher transfers can be achieved quickly, easily and safely. Before the introduction of the RAMP® the actual physical placement of linens behind a patient's back could put a caregiver at risk. This is especially true with dependent bariatric patients. With the RAMP®, patient transfers can occur with or without the patient in a "ramped" position.
- ***A Note on Spinal Support:*** The act of manually handling a dependent patient (especially a bariatric patient) may also induce injury to the patient's spine. The RAMP® distributes and supports the patient's weight evenly along the patient's spinal column. As the RAMP® is inflated it supports the natural curvature of the spine with a steady fluid upward motion. Further, there are no pressure points supporting the patient so the patient can remain in the ramped position for longer periods of time without compromising skin integrity.
- ***Airway Axes Alignment:*** The RAMP® standardizes the placement of a patient in the "ear to sternal notch" position. When a patient is properly positioned the three airway axes (oral, pharyngeal, laryngeal) are in optimum alignment, maximizing glottic exposure. Patient positioning is paramount to successful intubation. RAMP® clinical trials concluded a **40 percent improvement in Cormack-Lehane view** (50% I. grade; 25% II. grade; 25% III. grade). Conversely,

given the RAMP's[®] ability to rapidly position a patient and align the airway axes makes the application of patient positioning for extubation practical and minimizes the chance of tissue trauma when removing an airway.

- *Airway Patency:* The RAMP[®] system facilitates alignment of the airway axes through patient positioning to maximize airway patency. Of course, this effect is only beneficial as long as the patient remains positioned. The RAMP[®] system is manufactured with specially designed medical fabrics that conform to pressure management surfaces. Additionally, a double-layered patient surface covers seams to minimize pressure points and reduce shear. The result of the RAMP's[®] design is a system that patients can remain on in the correct position for extended periods of time. This feature of the RAMP[®] system offers a tremendous benefit to patients in immediate recovery from surgery and/or trauma and those in long term care. Additionally, since the RAMP[®] system can be finely adjusted to each patient's habitus to achieve the "ear to sternal notch" position, the RAMP[®] has a distinct advantage over just elevating the patient's chest and offers a level of customization for each patient in a way not achievable before.
- *Reduced Work of Breathing/Chest Wall Excursion:* When the patient is put into a "ramped" position, chest wall excursion stretches tissues promoting venous access. Additionally, the work of breathing is reduced and internal organ pressures against the diaphragm are greatly reduced. The benefit offered with the RAMP[®] is the ease at which the patient can be positioned and adjusted for both airway management and surgical or other procedures.
- *BVM Ventilation:* RAMP[®] clinical trials concluded a **38 percent subjective improvement** in BVM (Bag Valve Mask) ventilation - (criteria = yes/no, change/worse). While the RAMP[®] is useful for difficult to mask ventilate and/or intubate obese patients, the ease of use, single operator function, simplicity and efficiency make its application suited to all patients regardless of habitus.
- *Recovery:* If a difficult airway is encountered during prior patient treatment a RAMP[®] system should be positioned under the patient in recovery to facilitate an emergency airway re-insertion, should it be required. Typically any patient in recovery can benefit from the RAMP's[®] ability to position a patient to maximize airway management. The RAMP[®] can accommodate patients of any habitus or BMI.

Conclusion:

The RAMP[®] system from AirPal[®] Patient Transfer Systems, Inc. represents a sweeping change to the commonly accepted protocols concerning patient positioning for airway management. The RAMP[®] makes achieving alignment of the oropharyngeal and laryngeal axes routine, standardized and efficient. Perhaps equally as groundbreaking, the RAMP[®] functions as a patient transfer device while maintaining oropharyngeal and laryngeal axes alignment. Healthcare facilities can now offer a continuum of care cross departmentally with the RAMP's[®] safe patient transfer and airway management capabilities.

SYSTEM DESCRIPTION

Each AirPal® RAMP® System consists of the following components: 1) Integrated RAMP® and AirPal® Platform, 2) AirPal® Air Supply and Hose, 3) AirPal® Stand (Optional), 4) RAMP® Air Controller, and 5) AirPal® Platform User's Manual (attached to AirPal® Air Supply)

