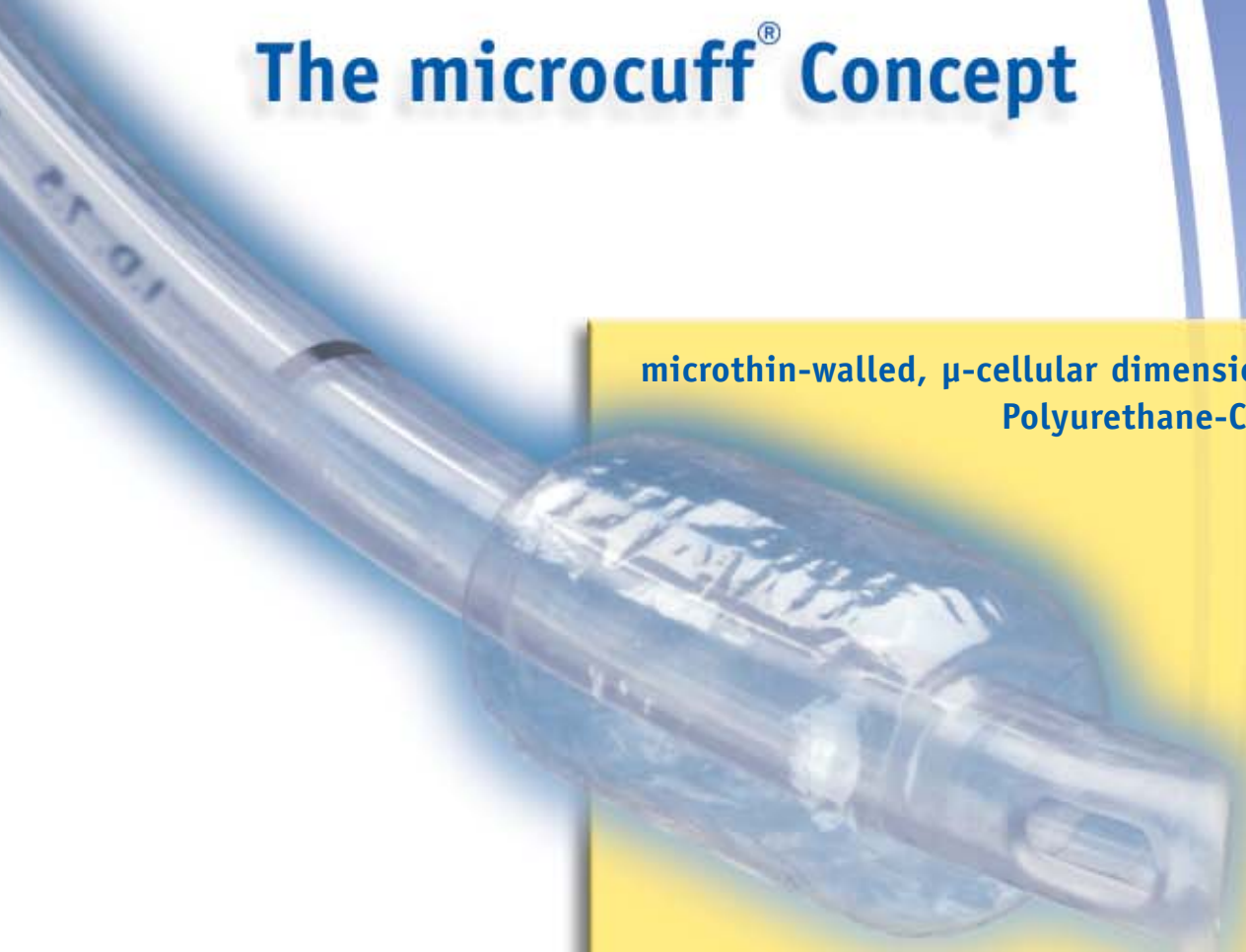




NEW

The microcuff[®] Concept

microthin-walled, μ -cellular dimensions
Polyurethane-Cuff



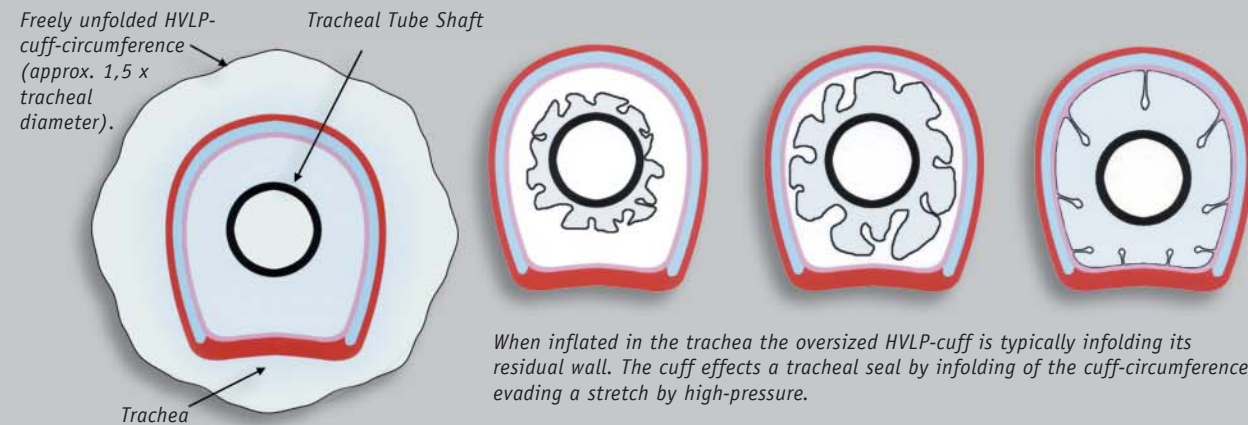
**Reaching New Frontiers
in Tracheal Protection
against Aspirated Secretions**

In the seventies, residually volumed, oversized by diameter, so called high-volume, low-pressure (HVLP) cuffs were introduced to prevent tracheal tissue damage during prolonged intubation, caused by excessively high cuff filling pressures.

However, conventional HVLP-Cuffs fail in regard of sealing against secretions from the Pharynx and the Gastrointestinal Tract. Quantitative examinations on cuff leakage indicate leakage rates beyond conventional high-volumed cuffs in the order of macroaspiration (Young 1997 (3), Oikkonen 1997 (4)).

▶ **Leakage and Aspiration of pharyngeal pathogenesis secretions by forming of Tunnels within the wall of conventional HVLP-Cuffs.**

■ **Conventional HVLP-Cuffs Sealing Failure**

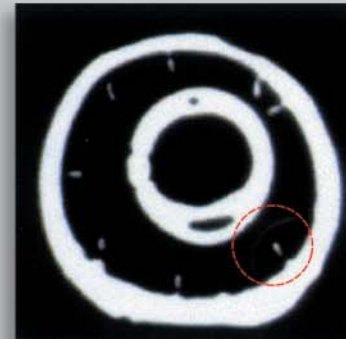


When inflated in the trachea the oversized HVLP-cuff is typically infolding its residual wall. The cuff effects a tracheal seal by infolding of the cuff-circumference, evading a stretch by high-pressure.

■ **Vertical formation of Tunnels within the Cuff-Wall**



Channels are formed at the blind end of the infolded cuff-wall. Pharyngeal secretions don't enter the trachea at the area of contact between cuff- and tracheal-wall. Leakage takes primarily place by formation of tunnels inside the cuff-wall.



CT scan (transversal) of an inflated HVLP-cuff in excised animal trachea (cuff-pressure: 25 mbar, secretions above cuff: 6 cm).

6 to 10 channels are typically formed inside the cuff-circumference.

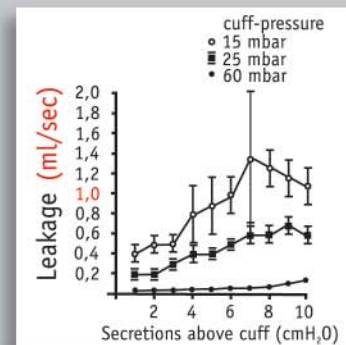
■ **Cuff-Leakage depending on Cuff-Filling-Pressures**

NMR scans of HVLP-cuff in model trachea at varying cuff pressures

Cuff-pressure – 25 mbar
Leakage primarily caused by formation of tunnels within the cuff-wall (up to 0,3 ml/sec).



Cuff-pressure – 60 mbar
Leakage of fluids caused by channels can not be eliminated, even at unphysiologically high cuff-filling-pressures.



Cuff-pressure – 15 mbar
Wide opening of the channels. The rate of leakage can reach up to 1 ml/sec.

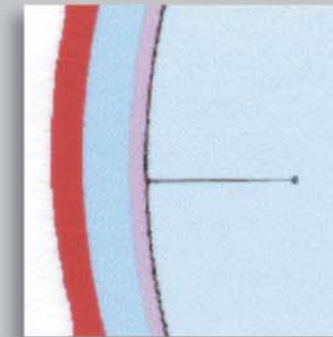


Young: 1997 (3)

microcuff® supersedes conventional PVC-cuffs by microthin-walled cuffs from Polyurethane.

▶ **Prevention of aspiration by microthin-walled cuffs from Polyurethane.**

■ **Protection against Leakage and Aspiration of Secretions**



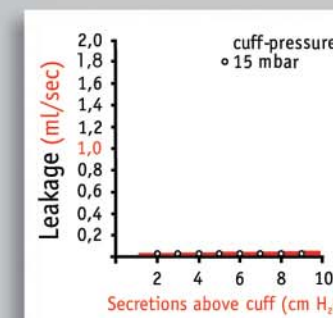
Based on polyurethanes, microcuff® reduces cuff-wall thickness to cellular dimensions (5 – 10 micrometers). Within the microscopic channels forming at the blind end of the cuff infoldings, capillary and adhesive forces are trapping the secretions and prevent their free passage.



CT scans (transversal) of a microcuff® HVLP-cuff in excised animal trachea. (Cuff-pressure – 25 mbar, secretions above cuff ~ 6 cm).

■ **Superior Sealing at lower Cuff-Filling-Pressures**

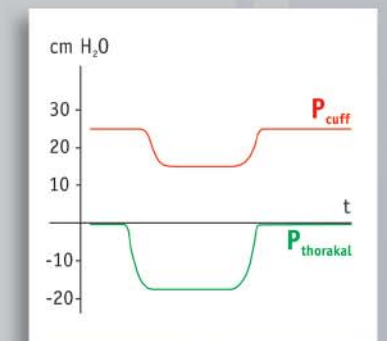
– even with the spontaneously breathing patient



Microcuff: 2001

The appropriate cuff-pressure necessary to seal the trachea against secretions can be significantly reduced with microthin-walled cuffs. microcuff® sets a new standard of cuff-filling-pressures between 15 to 25 mbar (~ cmH₂O) with adults.

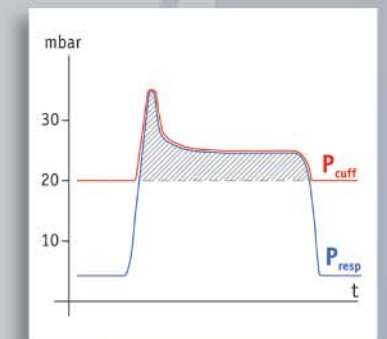
Intra-cuff-pressure is affected by the spontaneously patient's work of breathing in a thoracically positioned cuff. The cuff-pressure can vary significantly corresponding to the intrathoracic pressure. Even in extreme situations of respiratory mechanics microthin-walled cuffs are designed to provide a reliable seal.



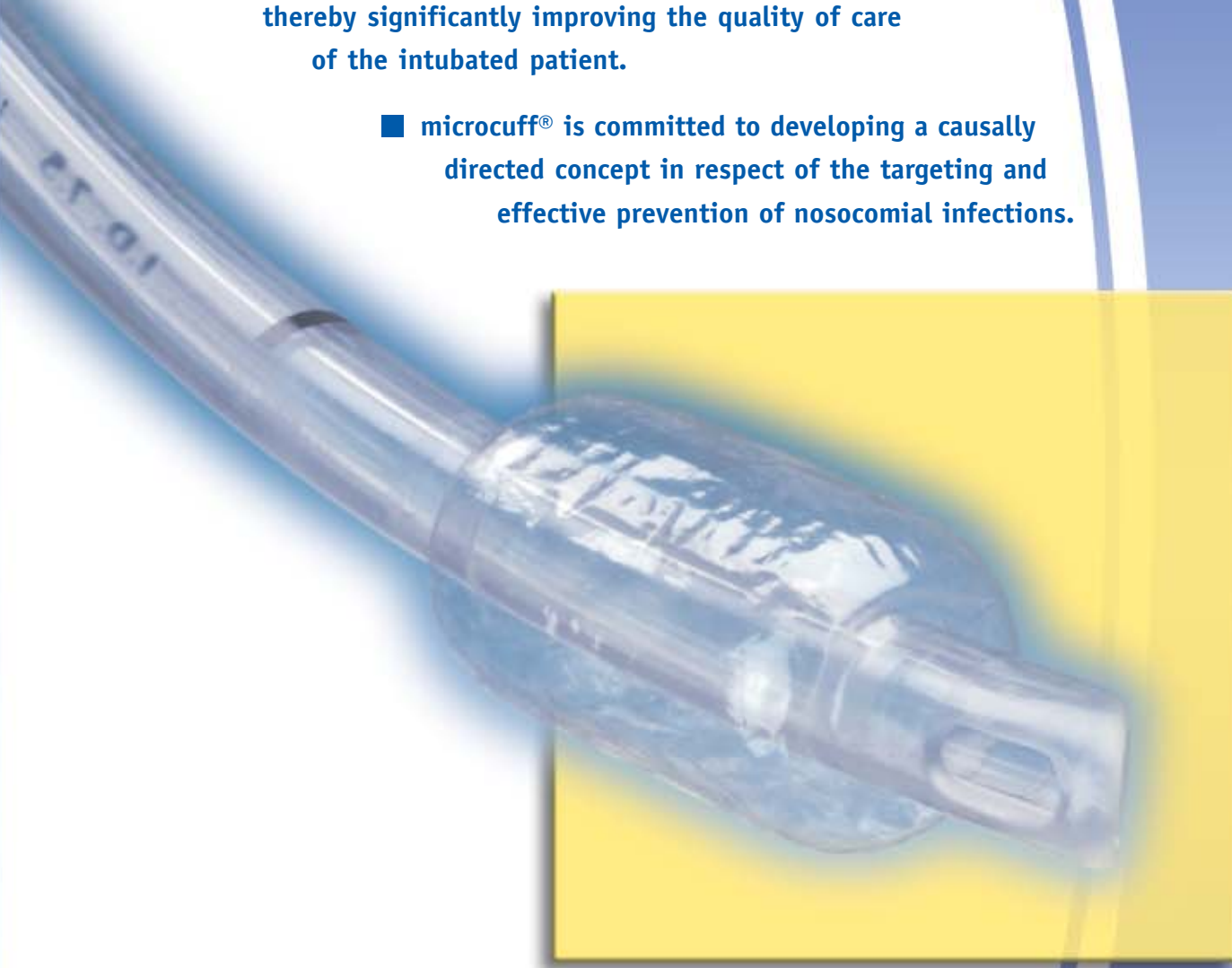
■ **Monitoring**

The inclusion of vital parameters in mechanical ventilation by monitoring cuff-pressure during individual breathing cycles (measurement of airway pressure, tidal-to-tidal calibrated automatical tube compensation, reduction of patient's work of triggering by appropriate respiratory triggering based on cuff-pressure).

Example: Measuring mean tracheal airway pressure: The respiratory pressure (P_{resp}) is transmitted to the cuff-pressure (P_{cuff}) when (P_{resp}) is exceeding (P_{cuff}). The cuff-pressure is here similar to the tracheal respiratory pressure (hatching). The microcuff® option to reduce cuff-pressure down to 15 mbar facilitates monitoring of tracheal peak- and plateau-pressures.



- Research at the University Hospital in Heidelberg Germany into the prevention of Ventilatory Associated Pneumonia (VAP) led to the development of microthin-walled cuffs that provided for effective tracheal sealing against (subglottic) secretions.
- microcuff® is actively engaged in the practical application of fascinating new material properties used in the area of cuff interface on all respiratory tubes and cannulas, thereby significantly improving the quality of care of the intubated patient.
- microcuff® is committed to developing a causally directed concept in respect of the targeting and effective prevention of nosocomial infections.



References:

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