Clinical evaluation of the Skin IQ™ Microclimate Manager and case reports
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Important information: Skin IQ™ Microclimate Manager units have specific indications, contraindications, safety information and instructions for use. Please consult product labelling and instructions for use. For instructions, compatibility and safety information specific to the bedmattress/frame, please consult product labelling provided by the manufacturer.

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INTRODUCTION

Despite decades of scientific and clinical interest in pressure ulcers, much remains unclear regarding their development. The primary role of high and/or prolonged mechanical loading on skin and soft tissue in pressure ulcer formation is widely accepted, and ameliorating the impact of mechanical loading (pressure and shear) has formed the cornerstone of pressure ulcer prevention. However, a complex array of extrinsic and intrinsic factors interact to improve or reduce the ability of the skin and underlying soft tissues to withstand mechanical loading. Potentially, one of the central factors acting both extrinsically and intrinsically is the microclimate at the interface between the skin and the supporting bed or chair. Microclimate is associated with two parameters — temperature (of the skin or the soft tissues) and humidity or skin surface moisture at the interface between the skin and support surface.

Excessive skin moisture and high relative humidity both weaken the skin and increase the friction coefficient, thus making the potential for pressure, shear and friction damage far greater. Higher skin temperatures raise the metabolic demands of local tissues, increasing the tissue's requirement for oxygen and susceptibility to the ischaemic effects of pressure and shear, and thus may be related to pressure ulceration.

Some support surfaces can influence the local microclimate through the movement of air over the patient's skin, or by mechanically moving the surface of the support away from the skin. The primary function of these devices is pressure redistribution, not microclimate control. However, a new device is now available that, when used in combination with a pressure-redistributing mattress, can provide control of the skin microclimate, including skin surface cooling, prevention of excessive moisture and reduced friction.

Skin IQ™ Microclimate Manager

The Skin IQ™ Microclimate Manager (Skin IQ™ MCM, Figure 1) is a mattress cover system that comprises three layers, designed to help reduce or maintain skin temperature, while preventing excess moisture or humidity building up on the skin's surface.

The polyurethane-coated woven nylon fabric top layer is vapour permeable, but fluid-resistant, helping to reduce shear and friction; the middle layer is formed of open cells that allow air to pass through the Skin IQ™ MCM; and the non-woven fluid-resistant vapour impermeable bottom layer helps prevent movement of the Skin IQ™ MCM over the top surface of the underlying pressure redistribution mattress.

The system uses a small negative airflow device attached to the 'foot' end of the Skin IQ™ MCM to pull air at room temperature through the outer layer and into the foam layer. Terned 'negative airflow technology', this proprietary process uses a fan to pull moisture and heat away from areas where the skin is directly in contact with the support surface (rather than blowing warm air onto the surface). This helps to lessen the risk of maceration and the coefficient of friction, further reducing shear forces that can lead to skin breakdown.

Finally, these three layers are all coated with an antimicrobial treatment that helps to control microbial growth. The top layer acts as a barrier to bacteria, fungi and viruses. Pressure redistribution is provided by the underlying support surface.

The Skin IQ™ MCM is designed to be compatible with many pressure redistribution mattresses on the market today, and does not affect the characteristics of the underlying surface. It is supplied for single patient, 30-day use, and can be applied without needing to move the patient from the bed. It only slightly increases the height of the support surface. The maximum weight of the patient using the Skin IQ™ MCM is 500lb (227kg).
The Skin IQ™ MCM is indicated for use with a pressure redistribution surface as an aid to the prevention and treatment of skin breakdown and pressure ulcers for patients who require microclimate management of the skin. There are no associated direct contraindications for the Skin IQ™ MCM, although the caregiver should refer to and follow contraindications in the product labelling for the pressure redistribution surface and/or bed frame being used with the Skin IQ™ MCM.

This document provides a review of a European evaluation involving the Skin IQ™ MCM. To date, 43 patients have been assessed in Germany and further patients have been reported on in The Netherlands, illustrating the use of the Skin IQ™ MCM in practice through a number of clinical case reports.

**CLINICAL EVALUATION OF THE SKIN IQ™ MICROCLIMATE MANAGER**

Using a mattress cover system to achieve microclimate control is not yet common practice in Germany. To evaluate the acceptance and usage of this new technique in acute care services, KCI Germany provided the Skin IQ™ Microclimate Manager (MCM) to several healthcare centres to assess nurses’ experiences of using it.

The following short report focuses on two key questions:

- What were the characteristics of the patients using the Skin IQ™ MCM?
- What was the perception of the nurses regarding patient comfort and ease of use of the Skin IQ™ MCM?

**Method**

A product evaluation was carried out between January and March 2011, and nurses were asked to complete a questionnaire.

**Data collection**

Nursing directors and head nurses of intensive care units in various university hospitals and specialised clinics in Germany were approached by the marketing staff of KCI Germany, and offered the use of the Skin IQ™ MCM.

All patients were expected to require a longer than average hospital stay, with expected or confirmed problems regarding microclimate control (such as sweating and fever). The decision to use the product was made by experienced nurses in intensive therapy units, neurology wards, palliative care wards, radiation therapy units, burns units and oncology wards.

**Patient characteristics**

Forty-three patients, with a wide range of diagnoses (Box 1), were included in the evaluation. They were mostly male (74%), with an average age of 60 years. The most common conditions were cancer (n=10), brain injuries (n=8), neurological conditions (n=11), and circulatory problems (n=8). Three patients had no diagnosis stated, while nine had other conditions, such as burns, palliative care, and acute respiratory insufficiency.

**Pressure ulceration: prevalence and risk**

Before the Skin IQ™ MCM was used, the prevalence of pressure ulcers was 20.9% (n=9 patients). The severity of pressure ulcers was categorised according to the NPUAP/EPUAP international guidelines (2009) as follows:

- One patient had category I
- Four patients had category II
- Two patients had category III
- One patient had category IV
- One patient had a pressure ulcer that was considered ‘unstageable’.

Box 2 details the level of risk for new pressure ulcer development within the recruited patients. The Braden Score ranged from 6 to 20 (median 11, data from two patients missing) suggesting that all except five patients required pressure ulcer preventive care.

**Reasons for prescribing the Skin IQ™ MCM**

The most common reason given by staff for using the Skin IQ™ MCM was sweating. Thirty-seven out of 43 patients (86%) complained of ‘sweating’ or ‘heavy sweating’. Nine patients (21%) had the additional problem of incontinence. The Skin IQ™ MCM was also used for patients with high levels of wound exudate, those in pain, or to prevent skin maceration. Furthermore, it was applied as a beneficial additional treatment for patients with burns or Lyell’s syndrome (toxic epidermal necrolysis).

**Mattresses used**

For 95% of patients, information on mattresses used underneath the Skin IQ™ MCM was available. In 21 out of 43 cases (49%), the Skin IQ™ MCM was used on top of a standard hospital mattress. In 13 cases (30%) it was used with a special foam mattress. In seven cases (16%) it was used with an alternating pressure system mattress. In two cases no information was given about the mattresses used. Clinical experience in Germany would
suggest that the Skin IQ™ can be used on a wide range of pressure redistribution mattresses and treatment was not discontinued for any patients due to a non- or ill-fitting mattress. The manufacturer’s recommendation is for the Skin IQ™ MCM to be used in conjunction with a pressure redistribution mattress.

**Patient outcomes**

The length of time that the Skin IQ™ MCM was used was documented in 18 patients. A minimum use of three days was recorded, with one patient remaining on the mattress cover system for 30 days. Mean and standard deviation of Skin IQ™ MCM use was 14.5 days (+/- 8.3 days). In 25 patients the duration of Skin IQ™ MCM use was not recorded and, of these, four were still using the device at the time of data analysis. Of the 18 patients for whom duration of Skin IQ™ MCM use was known, nine were discharged from hospital before the expected date of the end of the evaluation. Five patients moved from their initial ward and were lost to follow-up, while four died due to causes unrelated to this evaluation. No patients developed a pressure ulcer while using the Skin IQ™ MCM.

Nurses were asked to explain how microclimate problems had been managed before patients used the Skin IQ™ MCM. Frequent change of laundry and or dressings, use of additional skin care and regular re-positioning (if necessary) were the most common explanations given. Where issues of microclimate resulted from incontinence, nurses used urinary catheters, faecal management systems and specific barrier creams, such as Bactolan® (Praxisdienst).

**SKIN IQ™ MCM IN PRACTICE**

Nurses were asked for their views on the product, in particular:

- Their impression of the level of comfort provided by the Skin IQ™ MCM
- Ease of use of the system.

**Comfort**

In five cases, nurses made no comment about their experience of the Skin IQ™ MCM, or their perception of patient comfort while resting upon the device. In the remaining 38 cases (88.3%), nurses were satisfied with the device, and no negative feedback was given.

With regard to the 29 patients reported to be constantly moist or very moist according to their Braden scale...

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**BOX 1: Patient conditions**

<table>
<thead>
<tr>
<th>Recorded primary medical problem</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory</td>
<td>8</td>
</tr>
<tr>
<td>Cancer</td>
<td>11</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>3</td>
</tr>
<tr>
<td>Respiratory</td>
<td>1</td>
</tr>
<tr>
<td>Dermatological</td>
<td>4</td>
</tr>
<tr>
<td>Neurological</td>
<td>11</td>
</tr>
<tr>
<td>Digestive system</td>
<td>1</td>
</tr>
<tr>
<td>Palliative care</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
</tr>
</tbody>
</table>

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**BOX 2: Patients’ risk of developing pressure ulcers**

<table>
<thead>
<tr>
<th>Sensory perception (n=33)</th>
<th>Completely limited (33%)</th>
<th>Very limited (40%)</th>
<th>Slightly limited (12%)</th>
<th>No impairment (15%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (n=35)</td>
<td>Constantly moist (32%)</td>
<td>Very moist (51%)</td>
<td>Occasionally moist (14%)</td>
<td>Rarely moist (3%)</td>
</tr>
<tr>
<td>Activity (n=35)</td>
<td>Bedfast (68%)</td>
<td>Chairfast (14%)</td>
<td>Walks occasionally (12%)</td>
<td>Walks frequently (6%)</td>
</tr>
<tr>
<td>Mobility (n=35)</td>
<td>Completely immobile (43%)</td>
<td>Very limited (43%)</td>
<td>Slightly limited (9%)</td>
<td>No limitation (5%)</td>
</tr>
<tr>
<td>Nutrition (n=34)</td>
<td>Very poor (21%)</td>
<td>Probably inadequate (12%)</td>
<td>Adequate (53%)</td>
<td>Excellent (14%)</td>
</tr>
<tr>
<td>Friction and shear (n=35)</td>
<td>Problem (51%)</td>
<td>Potential problem (38%)</td>
<td>No apparent problem (11%)</td>
<td></td>
</tr>
</tbody>
</table>
sub-score, 21 nurses (72.4%) felt that their patients had been comfortable while using the Skin IQ™ MCM. Eight nurses (27.6%) did not comment on whether the Skin IQ™ MCM had improved patient comfort.

*Figure 2* details the perceived comfort of the patients using the Skin IQ™ MCM as reported by their nurses. Twenty-seven out of 43 (62.8%) patients were considered to be comfortable, and no one stated that they had experienced any discomfort.

**Ease of use**

*Figure 3* notes the nurses’ comments about the ease of use of the Skin IQ™ MCM in terms of its attachment to the underlying mattress. In thirty-three out of 43 (76.7%) cases, the combination of Skin IQ™ MCM and the mattress were found to be ‘easy’.

**CONCLUSION**

The patients who participated in this preliminary evaluation of the Skin IQ™ MCM within acute care settings in Germany presented with a wide range of medical conditions, were generally considered to be vulnerable to pressure ulcer development, and in 83% of cases their skin was very or constantly moist. Thus, this vulnerable patient population were at high risk of developing superficial pressure ulcers.

The evaluation identified that the device is easy to use on a variety of support surfaces, including standard foam mattresses, pressure redistributing foam mattresses and active therapy mattresses (alternating pressure air mattresses).

The placement of the Skin IQ™ MCM on the underlying mattress could potentially change, and perhaps reduce the pressure redistribution provided by the mattress alone. However, in this small evaluation, no patient developed a new pressure ulcer, perhaps indicating that the pressure-redistributing function of the underlying mattress had not been compromised.

Further controlled studies comparing the incidence of new pressure ulcers developing when using the Skin IQ™ MCM and where no use of the device occurs are needed. This would clarify the benefit of the device as an easy to use addition to support surfaces, that also provides microclimate management without compromising the mitigation of mechanical loads on the skin and internal tissues.

**REFERENCES AND FURTHER READING**


**KEY FACT: Incontinence management**

Incontinent patients require careful management of the skin, which needs to be protected from future exposure to urine and faeces with products that repel these fluids.
CASE REPORTS USING SKIN IQ™ MCM

The following stand-alone case reports demonstrate the experience from different clinicians using the Skin IQ™ MCM. Where possible, the product should be used in conjunction with a pressure redistribution mattress and combined with appropriate skin and wound care to achieve optimal results.

Case report 1

An 86-year-old female was admitted to the Military Hospital, Hamburg on 27 June 2011 for vertebroplasty surgery. Her American Society of Anesthesiologists (ASA) physical classification was II, indicating that she had mild systemic disease. She had both lumbar vertebra and pelvis ring fractures. The patient was confined to bed for the first four days after surgery. During this time, the patient was repositioned every two hours. Thereafter, the patient was mobilised twice daily (with the support of the nursing staff), when she sat in a chair for an hour. She also suffered from type 2 diabetes. She did not smoke or drink alcohol.

On admission, the patient’s skin was starting to break down in the sacral area and she had advanced mykosis, which was exacerbated by heavy sweating (Figure 4). Her laundry needed to be frequently changed and a daily skin care regimen was put in place, involving twice-daily washing with a skin care lotion and application of a fungicidal cream and cortisone.

A risk assessment was carried out to measure her levels of moisture, activity and mobilisation. Her nutritional status was also evaluated and she had a score of 8 points on the Braden scale.

She was initially placed on a non-energetic special foam mattress (AtmosAir™ 9000, KCI). This was thought to be appropriate for her body weight and the stage of her immobility. She was repositioned every 2–4 hours.

However, due to an increase in sweating and being immobile, it was decided to use Skin IQ™ MCM, which was placed on the mattress on 30 June 2011. The patient remained on this system until her discharge on 14 July 2011, when she was released to a special care home.

During this time, the mycosis improved and no pressure ulcers developed (Figure 5). The nurses found the Skin IQ™ MCM easy to handle and reported that they would use it for other patients.

The patient said that she felt comfortable and was relieved by the reduction in the level of moisture. This had previously impacted negatively on her quality of life, but this was now greatly improved.

Katrin Krahn, Department of Orthopaedic Surgery, Central Military Hospital, Hamburg, Germany
Case report 2

A 52-year-old female patient was admitted to the intensive care unit (ICU) with respiratory insufficiency, as a result of pneumosepsis of the left lung. The patient was morbidly obese, with a body mass index (BMI) of 45.3 and suffered from other comorbidities including type 2 diabetes, polyarthrosis, right ventricular heart failure chronic obstructive pulmonary disease (COPD), and hypoventilation syndrome.

The patient had grade 4 sacral pressure ulcers. Necrotic tissue was present and there were areas of undermining. She was also incontinent (of urine and faeces), which had contributed to the development of pressure ulcers from the combined effects of moisture, friction and pressure. Fever was also causing the patient to sweat profusely.

Treatment

The patient was placed on a Skin IQ™ MCM. A single cotton sheet was used on top of the device to help with manual repositioning of this morbidly obese patient.

Outcome

After only one week of treatment, the skin which had broken down as a result of moisture showed improvement (Figure 6). The necrotic tissue had reduced by 50–60% and epithelialisation was occurring. After two weeks the wound was still improving (Figure 7), but the condition of the patient had deteriorated and she was being assessed daily by the multidisciplinary team.
Case report 3

A male patient, aged 69, was admitted with acute respiratory insufficiency, heart failure, lung embolisms and an airway infection. The patient (BMI 21.5) suffered from several comorbidities, including type 2 diabetes and left facial paralysis following a cerebrovascular accident in 2010.

The patient had severe grade 4 sacral pressure ulcers. The wounds were necrotic and had an unpleasant odour (Figure 8). In addition, incontinence had led to moisture damage, which prevented treatment of the ulcers using negative pressure wound therapy.

**Treatment**
The patient was placed on a Skin IQ™ MCM and debridement was performed in the intensive care unit (ICU) to remove dead tissue. The wound was washed out using a topical antiseptic wound gel.

**Outcome**
One week after placement on Skin IQ™ MCM, the patient’s periwound skin had improved. He reported increased comfort, and relief that the odour had diminished, which had been causing him considerable distress (Figure 9). His fever also returned to normal, which meant that the number of linen changes per day could be reduced. Further improvement was seen after one month (Figure 10).

Healthcare professionals involved in the care of these ventilated patients, who were at high risk of developing pressure ulcers and moisture lesions, found that the Skin IQ™ MCM helped to prevent and treat moisture-related complications.

**Figure 8:** Skin before placement on the Skin IQ™ MCM

**Figure 9:** Skin one week after placement on the Skin IQ™ MCM and debridement

**Figure 10:** Skin one month after placement on the Skin IQ™ MCM

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**Ronny Manupassa**, Nurse Specialist in Wound and Tissue Viability, Canisius Wilhelmina Hospital, Nijmegen, The Netherlands
Case report 4

A 54-year-old African-American female with human immunodeficiency virus (HIV) presented with a clogged tracheostomy.

The patient had acute renal insufficiency along with methicillin-sensitive Staphylococcus aureus (MSSA) pneumonia. After tracheostomy, the patient suffered respiratory failure in addition to stool incontinence and encephalopathy with skin breakdown (Figure 11). Pre-albumin levels remained <5mg/L (severe malnutrition), with a C-reactive protein (CRP) level of 1.4 mg/L.

Initial treatment
The patient was placed on the Skin IQ™ MCM (Figure 12) and remained on it for two weeks (Figure 13). Paper blue pads were used to allow air flow. A single-layer draw sheet was placed on top of the Skin IQ™ MCM to assist when moving the patient. Critic-Ad® Clear Moisture Barrier Ointment (Coloplast, Minneapolis, MN) was applied twice daily, or as needed.

Discharge and follow-up
Skin breakdown resolved and the patient was discharged to acute rehabilitation.

Jean de Leon, Medical Director, Baylor Speciality Hospital, Dallas, US. This author presents on behalf of KCI.
Case report 5
This case involved a 63-year-old white female patient with a history of multiple abdominal surgeries, including ileostomy and reversal, small bowel obstructions and lysis of adhesions.

The patient was admitted for care of a complex abdominal wound following resection of the necrotic bowel. A subsequent gastric perforation with a jejuna patch was performed. A biological mesh was placed on the open abdominal wound. The patient suffered from chronic diarrhoea due to short bowel syndrome with skin breakdown (Figure 14).

Initial treatment
The patient was placed on the Skin IQ™ MCM. Additional materials used with this system were paper blue pads underneath the patient and a single draw sheet for positioning the patient. At the request of the patient’s family, a zinc-based barrier cream and cornstarch were applied.

Discharge and follow-up
Skin breakdown resolved after three weeks of placement on Skin IQ™ MCM (Figure 15) and the patient was discharged to a rehabilitation unit. Ten days after stopping treatment with Skin IQ™ MCM, the patient was readmitted with peri-rectal breakdown (Figure 16).

Jean de Leon, Medical Director, Baylor Speciality Hospital, Dallas, US. This author presents on behalf of KCI.
Case report 6
A 72-year-old white female with a history of congestive heart failure, hypothyroidism, tongue cancer and renal insufficiency was admitted for respiratory failure. She developed a Candida rash and skin tears (Figure 17).

Initial treatment
The patient was placed on the Skin IQ™ MCM and a pressure redistribution surface (Figure 18). Additional materials used with Skin IQ™ MCM were paper blue pads underneath the patient and a single draw sheet for positioning the patient. Critic-Aid® Clear Moisture Barrier Ointment (Coloplast, Minneapolis, MN) was applied twice-daily and as needed after bowel movements.

Discharge and follow-up
The skin breakdown resolved after two weeks’ placement on the Skin IQ™ MCM (Figure 19) and the patient was discharged.

Jean de Leon, Medical Director, Baylor Speciality Hospital, Dallas, US. This author presents on behalf of KCI.
Case report 7

This 67-year-old gentleman was admitted to hospital with lung metastases, secondary to prostate cancer and decompression of T11 and T12 for bone metastases. He was in heart failure and was unable to turn himself.

He was admitted to the intensive care unit (ICU) where he developed severe diarrhoea, which led to moisture lesions (Figure 20).

Treatment
The patient’s condition required him to sit up in bed, making it difficult to manage the lesions. An RIK™ Fluid Mattress (KCI) was used to provide pressure relief, with the Skin IQ™ MCM placed on top to manage the moisture lesions. He also received appropriate skin care, which involved washing the skin with Hydromol® melted in warm water and spraying Sorbaderm™ No-Sting Barrier Film (Aspen Medical) once every 12 hours. Incontinent pads were not used.

Outcome
This patient had a protracted stay in the ICU, followed by four weeks in a respiratory ward. He was finally discharged to a hospice for end of life care (Figure 21).

Although the moisture lesions improved slowly, they never healed due to the patient’s condition.

Fania Pagnamenta, Clinical Nurse Specialist (Tissue Viability), Newcastle upon Tyne NHS Hospitals Foundation Trust, UK
Case report 8

A 14-year-old girl presented with severe generalised recessive dystrophic epidermolysis bullosa (EB). In addition to skin fragility, chronic wounds and contractures, she has colitis and arthritis.

On presentation
The patient suffers constant pain from skin lesions and joint pain and receives regular opiates. She was also using morphine in hydrogel, which was applied topically to the wounds on her foot on a daily basis (Figure 24). Due to compromised temperature regulation from scarred areas of skin and bulky dressings, the patient felt extremely hot during the night, which added to her poor sleep pattern.

Treatment
Skin IQ™ MCM was suggested to promote comfort during the night, as she was constantly damp from sweat and the wounds on her feet were macerated from excess exudate.

The patient reported immediate comfort from the Skin IQ™ MCM. She has to get up to use the toilet several times a night and used to feel chilled and shivery from being damp. The exudate from the wounds on her foot reduced and the wounds showed signs of healing (Figure 25).

Outcome
The patient has continued to use the Skin IQ™ MCM, as she sleeps much better and her temperature regulation has improved.

The troublesome wounds on her feet healed, although new wounds develop constantly due to her extreme skin fragility (Figures 26 and 27). Due to the many variables influencing wound healing in EB, it would be difficult to quantify the role that Skin IQ™ MCM played in her wound healing, although immediate reduction in maceration must have been influential. However, the improved comfort due to temperature regulation and better length and quality of sleep has been sustained. Topical morphine in hydrogel is not currently required.

Jackie Denyer, Senior Clinical Nurse Specialist, Great Ormond Street Hospital, London, UK
Skin IQ™ Microclimate Manager (MCM) is a new type of coverlet that can be used in conjunction with a pressure redistribution mattress, together with appropriate skin and wound care, to manage the microclimate of a patient’s skin by drawing away moisture and heat.

For further information about the Skin IQ™ MCM, please go to www.kci-medical.com.
Skin IQ™ Microclimate Manager
The only directly accessible, single-patient-use mattress cover that can help reduce or maintain skin temperature, while preventing excess moisture or humidity building up on the skin’s surface.¹

In combination with a therapeutic support surface, the Skin IQ™ Microclimate Manager can be used for prevention and treatment of pressure ulcers, microclimate management and overall comfort.

¹Clark M, Black J. Skin IQ™ Microclimate Manager Made Easy. Wounds International 2011; 2(2).
Available at: www.woundsinternational.com