Digital Measurement of Nocturnal Scratch: New Developments

June 4, 11AM ET
Recent Regulatory Feedback

June 11, 11AM ET
Updates from R&D of Algorithms and Tools

June 18, 11AM ET
Processes, Validation and Adoption
But first, housekeeping

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  • Slides and recording will be available on DiMe’s webinar page after the session
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  • ‘**Raise your hand**’ in the Reactions and the moderator will unmute you to ask your question live, or
  • **Type your question** into the chat box

*** Participants are not permitted to transcribe this webinar, violators will be removed from the session.***
Digital Measurement of Nocturnal Scratch: New Developments

June 4: Recent Regulatory Feedback
June 11: Updates from R&D on Algorithms and Tools
June 18: Processes, Validation, and Adoption

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Chief Strategy Officer: Research, Medical & Community Affairs, NEA

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Director of Digital Health Sciences
ActiGraph

Carrie Northcott, PhD
Head of Digital Sciences
Pfizer (moderator)
Patient Burden of the Itch-Scratch Cycle in Atopic Dermatitis

Wendy Smith Begolka, MBS
Chief Strategy Officer – Research, Medical & Community Affairs
wendy@nationaleczema.org
June 11, 2024
Atopic Dermatitis – Common, Chronic & Serious

- **Leading contributor to skin-related disability globally**
  - Ranks 15th among all non-fatal diseases
- **Affects over 31 million Americans of all ages and races**
  - 9.6 million children (<18 years)
    - 33% with moderate to severe disease
  - 16.5 million adults
    - 40% with moderate to severe disease
- **Typical onset at <5 years of age**
  - Persistence can occur childhood to adulthood
  - Can occur in adulthood for the first time
  - Second peak of prevalence after age 60
Most Burdensome Symptoms of AD

THREE MOST PROBLEMATIC ECZEMA SYMPTOMS

- Itching: 79%
- Red, inflamed skin: 47%
- Sleep disturbance: 29%
- Dry, sensitive skin: 23%
- Rough, leathery or scaly patches of skin: 20%
- Oozing or crusting: 19%
- Peeling or flaking skin: 19%
- Pain: 16%
- Anxiety: 11%
- Depression: 9%

https://www.morethanskindeep-eczema.com/
Most Burdensome Symptoms of AD

Cesnakova L et al. Skin Health Dis. 2023;3:e262.
• >98% of individuals described their itch as ‘annoying’, ‘bothersome’, ‘unpleasant’ or ‘bothering’
• Participants reported itch/scratch more frequently at night, in the evening and during the winter
“Whatever the causes, I’ve spent countless nights in the grip of itch, tearing at my skin to wake in the morning with crusty gashes on my hands, face, and elsewhere.”

“I still wake up unconsciously clawing at my skin. When I itch during the day I can find a distraction or I can try and control it, but there’s no control over scratching in my sleep.”

“I am a 50-year-old, lifelong sufferer. Most of you know the clinical definition of eczema, but please allow me to give you my personal definition of the disease. I call it torture. I endure endless bouts of itchy, torn open, bleeding, oozing, red, flaky skin from head to toe.”

“At its worst, my eczema kept me from being able to sleep at night. I just wanted to scratch all night long since it felt like fire ants were walking all over my entire body. My skin was so itchy, hot and felt like it was going to burst.”

“The itch is so bad that I bruise myself from scratching. Lost sleep has really affected my well-being. I am exhausted and sometimes don’t feel mentally prepared for the day.”

1. Yosipovitch G. Living with Itch: A Patient’s Guide
3. https://nationaleczema.org/focus-on-jim/
Itch-Scratch Reduction #1 Treatment Goal

MOST IMPORTANT RESULT THAT A TREATMENT COULD PROVIDE PATIENTS WITH ECZEMA

- Immediate and sustained reduction in pain and itch: 51%
- Reduction in frequency of flares: 25%
- Increased ability to go about daily life: 10%
- Relief from the social/emotional effect of eczema: 6%
- Increased ease of overall treatment plan (fewer medications, fewer routines to follow, fewer doctor visits, etc.): 5%
- Reduction in cost of overall treatment plan: 2%
- Prevention or delay in onset of comorbidities: 1%

https://www.morethanskindeep-eczema.com/
Holistic Assessment of AD is Needed

• **AD is largely a patient-reported disease**, however clinician-reported measures (ClinRO) predominate AD assessments.

• **Use of patient-reported outcomes (PROs) are increasing** (often itch or sleep) yet restricted to periodic care encounters.

• **Opportunity exists to complement care setting measures with real-world data** from patients and/or other disease tracking mechanisms to improve:
  
  • Self-monitoring and personal disease management
  • Shared decision making and clinician-supported disease management
  • Understanding of clinical trial and real-world treatment effectiveness and unmet needs
• Standalone mobile health (mHealth) apps – both general health and disease-related are becoming more widely available.
  • As of 2020 over 84M persons in the US have used apps with health and health-related content.¹
  • 12 eczema-specific mHealth apps available in the US
    • Tracking (w/ or w/o AI), education, shared decision making
    • EczemaWise by NEA²

2. https://www.eczemawise.org/
• **Wearable digital health technology** – both general health and disease-related.
  
  • 45% of Americans wearing some form of smartwatch as of April 2022.¹
    
    • 92% of smartwatch users reported that they used the devices to maintain/manage their health
  
  • Other sensor-based devices
  
  • Many also linked to an mHealth app for patient information

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¹ N Engl J Med 2023;389:2100-2101
Opportunities for Ongoing Patient Involvement

- Patients have a significant role in AD care evolution
  - Determining what metrics are most meaningful in clinical trials and the real-world
  - Willingness to use – stickiness, tolerability, and frequency of use
  - Determining meaningful levels of change
  - Use for self-monitoring and self-management
  - Use to inform treatment decisions
Digital Measurement of Nocturnal Scratch

Jaydev Thakkar, COO, Biofourmis
June 11’ 2024
Biofourmis Solutions Delivering Care Across the Continuum

**Hospital & Health Systems**
Deliver care to clinically-appropriate acute patients at home

**Transitional Care**
Enable patients to more easily move from acute to post-acute sites of care

**Remote Patient Management**
Help prevent decompensation post-discharge and reduce re-hospitalizations

**Focus Applications**

**Digital Clinical Trials**
Onboard, manage, and communicate remotely with trial participants

**Digital Drug Companions**
Technology and support services to promote participant engagement and retention

**Digital Measures, Biomarkers & Endpoints**
Harness physiologic data leading to more informed patient strategies

**Payors & Risk Bearing Entities**
Enable patients to more easily move from acute to post-acute sites of care

**Life Sciences & BioPharma**
Help prevent decompensation post-discharge and reduce re-hospitalizations

*Subject to geographic availability*
Opportunity to Optimize Drug Lifecycle Value

Pain Points
- Time & cost of discovery of molecule
- Dose optimization
- Collecting RWD, cohort insights
- Safety surveillance
- Collecting RWD
- Patient recruitment and diversity
- Collecting RWE, managing REMS
- Dosing, HEOR, Patient engagement, adherence, care delivery, QOL data
- Market access and penetration, patient persona segmentation

Phase 1
- Early-stage Candidates
  - Precision medicine that uses biomarkers and AI/ML tools. Allows dose titration and optimization personalized for each patient.
  - Early evidence to advance promising candidates, or “fail fast” unsuitable ones
  - Differentiation through SaMD development

Phase 2
- Mid/Late-stage Candidates
  - Patient-centric digital biomarkers as surrogate endpoints to speed clinical development
  - Remote/ decentralized monitoring for enhanced patient experience and access to diverse population
  - Biosensor data for improved assessment of efficiency, side effects, and outcomes

Phase 3
- Commercialization & RWE
- Commercialization & RWE

Co Development · Digital Biomarkers | SaMD | Digital Companions

Clinical Development and Digital Trials

Commercial Validation & Market Access

Marketed Drugs
- Integration into our disease-specific dynamic care pathways to optimize care delivery
- Observational data and surveillance to inform FDA post-market drug safety monitoring
- Outcomes data so reimbursement can be informed by the outcomes of real-world patients
Biofourmis Platform for Digital Clinical Trials

Combines integrated wearable biosensors, analysis/interpretation software (SaMD), continuous remote data collection, and digital endpoints to measure drug efficacy and safety.

Platform enabling Remote Data Collection & Analysis

- Notification Management & Interventions
- Detection or Prevention of Clinical Events
- Multi-variate Physiology Analysis (Detect Deviations from Baseline)
- Disease Specific Digital Biomarkers or Digital Endpoints
- Raw Biosensor Processing & Physiology Monitoring

Operational Infrastructure to support use of digital technologies

- Regulatory & Compliance
- Safety Monitoring
- In-Home Services
- Logistics Support
- Clinical & Technical Support

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Measuring Nocturnal Scratch in AD

Scratch & Sleep Algorithm
The technology was developed by a major Pharma and has been licensed by Biofourmis to be an exclusive independent distributor to ensure competitive confidentiality and data privacy.
Measuring Nocturnal Scratch and Sleep in AD

- **What:** Validated (in Atopic Dermatitis) nocturnal scratch digital tool to measure quantitatively, passively and in an unbiased manner *nocturnal scratching* (# of events and duration) and sleep quantity to provide endpoints with high accuracy, specificity and sensitivity

- **How:** Using sensor-generated data and validated algorithms, we collect essential information about patients’ nighttime scratching, measuring and quantifying this behavior in real-time.

- **Who:** validated in patients from 2-75 years of age
Using digital health technologies to improve the lives of patients with Atopic Dermatitis

1. Development of Nocturnal Scratch and Sleep Algorithms
2. Validation of Nocturnal Scratch and Sleep Algorithms
3. Clinical Trial Applications
Development of Nocturnal Scratch and Sleep Digital Health Measures

(Devic agnostic algorithms)

Validation of Nocturnal Scratch and Sleep Digital Health Measures

2

Validated Nocturnal Scratch and Sleep Algorithms

- Correlation of Nocturnal Scratch to "ground truth" with video annotation

Accurately, measure Nocturnal Scratch and Sleep, compared with gold Standards

1) Scratch and Sleep Quantification in Atopic Dermatitis (SQUAD) ClinicalTrials.gov Identifier: NCT03490877
2) Monitoring of Scratch via Accelerometry in Children (MOSAIC) ClinicalTrials.gov Identifier: NCT03873220
3) Scratch Behavior Under Standard of Care (SOC) ClinicalTrials.gov Identifier: NCT03898427
Clinical Trials completed to validate the technology

- **NCT03490877**
  - Scratch and Sleep Quantification in Atopic Dermatitis (SQUAD)
    - Mahadevan et al. 2021 and Beck et al. 2021
    - N = 45
    - age: 31.7 ± 16.0 [12-75]
    - sex: 29 (64.4%) male, 16 (35.6%) female
    - race: 1 (2.2%) Asian, 23 (51.1%) Black / African American, 21 (45.7%) White

- **NCT03873220**
  - Monitoring Of Scratch Via Accelerometry In Children (MOSAIC)
    - Northcott et al. 2020
    - N = 41
    - age: 5.7 ± 2.9 [2-11]
    - sex: 18 (43.9%) male, 23 (56.1%) female
    - race: 22 (53.7%) Black / African American, 5 (12.2%) Hispanic / Latino, 9 (22.0%) Multiracial, 2 (4.9%) White, 3 (7.3%) Other

- **NCT03898427**
  - Scratch Behavior Under Standard of Care (SOC)
    - N = 120, ages 2-75, validation cohort
  - Additional clinical trials exist in which SleepPy and ScratchPy algorithms are used for exploratory endpoints
### Associated digital endpoints

<table>
<thead>
<tr>
<th>Digital Measure</th>
<th>Type</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSO</td>
<td>Sleep</td>
<td>Minutes</td>
<td>Largest window of time where sleep is the intended behavior.</td>
</tr>
<tr>
<td>TST</td>
<td>Sleep</td>
<td>Minutes</td>
<td>Total time spent asleep during the total sleep opportunity window.</td>
</tr>
<tr>
<td>PST/Sleep Efficiency</td>
<td>Sleep</td>
<td>Percentage</td>
<td>Percentage of the total sleep opportunity window spent in the sleep state.</td>
</tr>
<tr>
<td>WASO</td>
<td>Sleep</td>
<td>Minutes</td>
<td>The periods of wakefulness occurring after defined sleep onset.</td>
</tr>
<tr>
<td>Number of Wake Bouts</td>
<td>Sleep</td>
<td>Integer</td>
<td>Number of times of wakefulness that occurred following sleep onset.</td>
</tr>
<tr>
<td>Total scratch events</td>
<td>Scratch</td>
<td>Counts</td>
<td>Total scratch bouts during the total sleep opportunity window.</td>
</tr>
<tr>
<td>Total scratch duration</td>
<td>Scratch</td>
<td>Minutes</td>
<td>Total time scratching during the total sleep opportunity window.</td>
</tr>
</tbody>
</table>

PST = percent sleep time; TSO = total sleep opportunity; TST = total sleep time; WASO = wake after sleep onset.
Drug-mediated Changes in Nocturnal Scratch and Sleep

Clinical Trial
Applications

- Drug-Induced changes observed

Abrocitinib resulted in a general reduction in scratch duration.

Abrocitinib showed a general improvement in sleep efficiency.

ClinicalTrials.gov Identifier: NCT04345367

- Di J, Christakis Y, Mamashli F, Kelekar A, Bruno J, Zhang Y, and Northcott CA. One scratch at a time: Nocturnal scratch and Sleep improvements in Atopic Dermatitis with Abrocitinib. EADV, Aug 2022
Did the participants find the devices comfortable?

• At the end of the studies the participants (or caregivers) were asked if they found the devices comfortable and their likeliness to wear the devices continually.
• Patients with AD felt the devices were comfortable to wear.

### ADULTS

**SQUAD; 12 – 75 years old**

### CHILDREN

**MOSAIC; 2 – 11 years old**
## Validation Roadmap - Several Years of Work is Already Completed

<table>
<thead>
<tr>
<th>Study</th>
<th>Activity</th>
<th>Objective</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative study</td>
<td>Concept elicitation</td>
<td>Establish nocturnal scratch as an important concept that matters to AD patients</td>
<td>- Structured interviews with patients and their partners, further supported by survey data from patients and caregivers.</td>
</tr>
</tbody>
</table>
| Feasibility & Analytical validation study (non-therapeutic) – evidence may be available from DHT manufacturers | DHT Feasibility | Demonstrate patient feasibility of deploying DHT to collect data in patients with AD | - Patient feedback on the use of the DHT  
- Evaluate compliance  
- Understand barriers and facilitators for patients, for example through a structured questionnaire, to enable optimum deployment in future studies |
| | Analytical Validation | Demonstrate operational feasibility of deploying DHT to collect data in patients with AD | - Clinical site feedback on the use of the DHT  
- Identify operational issues arising from DHT deployment (e.g., technical issues, DHT-related adverse events (AEs))  
- Understand operational barriers and facilitators, for example through a structured questionnaire, to enable optimum deployment in future studies |
| | Analytical Validation | Assess the performance of DHT in measuring nocturnal scratch (duration, number of events) in patients with AD | - Comparison to gold standard measure, e.g., videography and polysomnography |
| | Evaluate the reliability of DHT-derived nocturnal scratch measures | Within-patient coefficient of variation of nocturnal scratch measures over various periods of time |
| +Therapeutic study(ies) | Analytical Validation | Evaluate the sensitivity of change of DHT-derived nocturnal scratch measures | - Explore changes over time (e.g. relative rate of change over time) |
| | Clinical Validation | Evaluate correlations between proposed measures and other clinical outcomes | - Correlation of DHT-derived nocturnal scratch measures with:  
  - PROs (e.g. NRS itch)  
  - Skin lesions  
  - Primary/secondary efficacy assessments, e.g. EASI SCORAD or vGQA-AD |
| | Minimal Meaningful Change | Define minimum meaningful change that can be interpreted as treatment benefit | - Anchor-based methodology (e.g. using PGI-S as an anchor) as well as distribution-based methods as supportive.  
  - Literature supporting the meaningful changes observed in standard sleep and scratch/lesion measures |
Participant Experience

**Wearable**
Worn continuously to collect vitals data and identify patterns

**ePRO**
Prompts patient to report symptoms (i.e. itch levels, sleep patterns) to better understand participant condition

**Smart Notifications**
Timely prompts in app to notify participant of required study activities

**AI Algorithm**
Integrated into Biofourmis platform using ePRO and wearable data to generate evidence

**Patient/Clinician Connectivity**
Two-way connectivity allows participant to interact with study staff and request support

**Education**
Participant engages with in-app education material to understand the disease and the importance of adhering to treatment
Biofourmis Logistics Services deliver complete device life-cycle management

**Study Site**

- **Preconfigured devices** deployed at study sites or shipped to patient’s home for setup via remote, real-time customer support
- Packaging options may be **reusable and customizable** to meet customer needs

**Home**

- **24/7 Biofourmis support team** assists with device issues and can replace defective devices within ~24 hours
- Upon completion, devices can be returned to Biofourmis to be cleaned/disinfected, tested, and redeployed to new patients

(Sample devices shown to illustrate participant kit. Actual kits will vary dependent on study protocol and connectivity requirements.)
Biofourmis Vision:

Development of a commercial solution to analyze various data inputs such as skin images, environmental factors, lifestyle habits, and treatment history to provide personalized recommendations for managing Atopic Dermatitis

1. **Personalized Treatment Recommendations**: By analyzing individual patient data, such as medical history, symptoms, environmental triggers, and treatment responses, the algorithm can provide personalized treatment recommendations tailored to each patient's specific needs. This can improve treatment effectiveness and patient outcomes.

2. **Early Detection and Intervention**: Machine learning algorithms can identify patterns and early indicators of disease exacerbation or flare-ups based on patient-reported symptoms and environmental factors. This allows for early intervention and proactive management, potentially reducing the severity and frequency of flare-ups.

3. **Educational Resources**: The patient app can provide educational resources about atopic dermatitis, including information about the condition, common triggers, lifestyle modifications, and treatment options. This empowers patients to better understand their condition and actively participate in their care.

4. **Symptom Tracking and Monitoring**: Patients can use the app to track their symptoms, medication usage, and environmental exposures over time. The AI algorithm can analyze this data to provide insights into symptom patterns, treatment efficacy, and potential triggers, facilitating more informed discussions between patients and healthcare providers during clinic visits.
Thank you!

- For questions/inquiry: Jaydev.Thakkar@biofourmis.com
DECODE
Nocturnal Scratch

Sylvain Zorman, Director Digital Health Sciences
Nocturnal scratch is cardinal to patient with eczema

1- “in bed, I left a **trail of blood, skin, and tears**”

2-“I still **wake up unconsciously clawing at my skin**. When I itch during the day I can find a distraction or I can try and control it, but there’s no control over scratching in my sleep.”

3-“I’d **wake every few hours, bloody and in tears** because I had ripped everything off in my sleep because **my skin felt like it was on fire**”

4-“Feel the heaviness of having **tear-stained eyes** whenever you hear your child’s **pained cries for relief** from yet another **bout of nightly scratching**.”

5-“I remember taking turns with my wife, **lying awake at night, holding Drew’s arms down** so he wouldn’t scratch and **peel the skin off his face and throwing away his bloodstained clothes** because we just didn’t want to wash them”

6-“When my son’s eczema was the most severe, he would **shed a pile of dead skin nightly**. He was in so much pain even the air hurt. His skin oozed and peeled. He **scratched**, and it was **very difficult to sleep**. I would sleep with him to **hold his hands down to not injure himself further**.”
“Measure what is measurable, and make measurable what is not so” Galileo

- High burden
- Low sensitivity
- Not scalable

1975: self-winding watch

1998: nail

R. Felix et al. 1975
Kurihara 2013

Machine Learning
Adoption of wrist actigraphy by pharmaceutical sponsors

Pharma initiatives
- Pfizer (Mahadevan et al. 2021)
- Lilly (Ju et al. 2023)
- AbbVie (NCT04262791)
- Sanofi (NCT05235724)

Past consortiums
- DME (Digital Medicine Society)
- NOCTURNAL SCRATCH

Pharma Development:
- Technology agnostic approach
- Delivered in 2023

Delivering fit for purpose technology
**Workstreams**

**Analytical validation study:**
- ~60 participants (atopic dermatitis and psoriasis)
- Comparison between wrist-based measure and video recording

**Health authority engagements:**
- FDA: DHT Steering committee
- EMA: Innovation Task Force meeting

**Usability:**
- Evaluate ways to maximize compliance
- Operational recommendations

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**Key Milestones**

![Timeline Image](image-url)

- **Q4 2023**
  - IRB Approval
  - First Patient First Visit

- **Q1 2024**
  - Kick-off
  - FDA DHT-SteerCo Meeting

- **Q2 2024**
  - Interim analysis
  - Last Patient Last Visit

- **Q3 2024**
  - FDA DHT-SteerCo Meeting

- **Q4 2024**
  - Final Study report

- **Q1 2025**
  - EMA ITF Meeting (TBD)

- **Q2 2025**
  - Interim analysis

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**ActiGraph**

- Founding Project Partners
  - Johnson & Johnson
  - Janssen
  - Takeda

- Project Collaborators
  - UCB
Deliverables and benefits

**Critical mass**
- Consensus building
- Dissemination
- Cost reduction

**Evidentiary dossier**
- Verification
- Validation
- Usability

**Regulatory buy-in**
- Derisking future engagement
- Faster approval
- Lower the regulatory barrier
Thank you!

www.theactigraph.com  info@theactigraph.com
Digital Measurement of Nocturnal Scratch
New Developments

Advanced **Wearables** for Scratch Monitoring

June 11th, 2024
Measuring Itch: A Growing Number of Choices

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Domain</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itch</td>
<td>Patient Skin (Appearance)</td>
<td>EASI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SCORAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IGA</td>
</tr>
<tr>
<td></td>
<td>Patient Perception</td>
<td>PROs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NRS</td>
</tr>
<tr>
<td></td>
<td>Patient Behavior (Scratch)</td>
<td>Video Based</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wearables</td>
</tr>
</tbody>
</table>

**Table 1: Eczema Area and Severity Index**

The EASI score rates the four involved regions (head and neck, trunk, upper extremities, and lower extremities) on a 0% to 100% scale for each region.⁹

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Clear or no lesions</td>
</tr>
<tr>
<td>0.1-1</td>
<td>Almost clear</td>
</tr>
<tr>
<td>1.1-7</td>
<td>Mild disease</td>
</tr>
<tr>
<td>7.1-21</td>
<td>Moderate disease</td>
</tr>
<tr>
<td>21.1-50</td>
<td>Severe disease</td>
</tr>
<tr>
<td>&gt;51</td>
<td>Very severe disease</td>
</tr>
</tbody>
</table>

![Image showing symptom measurement tools]

![Image showing symptom scale]
Novel Digital Endpoints: ADAM™

**Suprasternal Notch**
Monitor patient health remotely with ten unique digital biomarkers such as swallowing and talking with a single device on a single body location.

**Scratch and Sleep**
A single device that can quantify scratching behavior such as scratch duration and intensity as well as standard sleep metrics.

**Full Body Movement**
Track body movements with a high degree of accuracy to characterize motor performance.
ADAM: Motion + Sound Sensing
Highly Specific and Sensitive for Scratch Sensing

- High Frequency Accelerometer
  - x, y-axis: 200 Hz
  - z-axis: 1,666 Hz

- ERM haptic motor
  - Maximum of 10,000 RPM
  - 1.4 G vibratory feedback

- Top Encapsulation
  - Soft
  - Stretchable
  - Water-proof

- Microcontroller
  - Low power
  - Wireless communication

- Rechargeable Battery
  - Wireless charging
  - Operation time: >35 hours
  - Monitoring time: 1 week

- Bottom Encapsulation
  - Soft
  - Stretchable
  - Water-proof

1. Mount ADAM on hand
2. Continuous Scratch Monitoring
3. Haptic Feedback Triggered

- Scratch detected
- No Scratch
The Tech

Output
- Scratch events
- Scratch intensity
- Total sleep time
- Sleep efficiency
- WASO

ADAM captures sleep and scratch metrics on a single device with AI and edge computing

The Validation

Pediatric AD: F1 83% | Sensitivity 84%

Adult AD: F1 90% | Sensitivity 93%
Scratch in AD Survey
What do patients care about when it comes to scratching beyond nocturnal scratching?
Characterizing Scratching Across 3 Key Domains

- **Intensity**: How intensely does a patient scratch?
- **Events**: How often does a patient scratch?
- **Duration**: How long does a patient spend scratching?

**Awake**

**Asleep**
What Do Patients Care About When It Comes to Scratching (n=72 AD patients)?

**Knowing how many times I scratch while awake would be meaningful**

- **Strongly Agree**: 18 (25.0%)
- **Disagree**: 15 (20.8%)
- **Agree**: 22 (30.6%)
- **Neutral**: 9 (12.5%)
- **Strongly Disagree**: 8 (11.1%)

**Knowing how many times I scratch while asleep would be meaningful**

- **Strongly Agree**: 21 (30.4%)
- **Disagree**: 14 (20.3%)
- **Agree**: 17 (24.6%)
- **Neutral**: 8 (11.6%)
- **Strongly Disagree**: 9 (13.0%)

43% of AD patients agree or strongly agree that knowing how many scratch events in the day is meaningful to them.

55% of AD patients agree or strongly agree that knowing how many scratch events at night would be meaningful to them.

12% of respondents agreed or strongly agreed that nocturnal scratching would be meaningful to them compared to day time scratching.
While awake, I am most bothered by ...

1 = Most bothered by

2 = Second most bothered by

3 = Least bothered by

While awake, it was scratch intensity again!
While asleep, I am most bothered by…

1 = Most bothered by

While asleep, it was scratch intensity…

3 = Least bothered by

No. of Participants

Rank

- Average Scratch Intensity
- Number of Scratch Episodes
- Total Scratch Time
What Do Patients Care About When It Comes to Scratching (n=72 AD patients)?

I would prefer a medical treatment that targets ...

The most patients ranked scratch intensity as what they would like a medical treatment to target
What Do Patients Care About When It Comes to Scratching (n=72 AD patients)?

### The Most Meaningful Scratch Measurement

<table>
<thead>
<tr>
<th>Rank</th>
<th>1 = Most Meaningful</th>
<th>3 = Least Meaningful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Average Scratch Intensity</td>
<td>34</td>
</tr>
<tr>
<td>2</td>
<td>Number of Scratch Episodes</td>
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<tr>
<td>3</td>
<td>Total Scratch Time</td>
<td>24</td>
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The most patients ranked scratch intensity as the most meaningful measurement.
Scratch Intensity with ADAM: Translating Motion to Force

A. Image of a scratch with ADAM device attached.

B. Graphs showing acceleration over time for different intensity levels:
   - Low Intensity Scratch: Average Force 0.63 N
   - Moderate Intensity Scratch: Average Force 1.41 N
   - High Intensity Scratch: Average Force 2.95 N

C. Scatter plot showing force (N) vs. power (g2) with a trend line.

D. Graphs showing acceleration over time with labeled powers:
   - Power: $2.67 \times 10^{-6}$
   - Power: $1.30 \times 10^{-5}$
   - Power: $2.13 \times 10^{-5}$
# Global AD Scratch Validation Studies with ADAM

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Subjects</th>
<th>Nights</th>
<th>Hours</th>
<th>Performance</th>
<th>Adherence*</th>
<th>Publication</th>
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<td><strong>Sibel Internal Validation Studies</strong></td>
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<td>Adult AD with Biofeedback</td>
<td>Adult AD</td>
<td>10</td>
<td>114</td>
<td>791</td>
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<td><strong>Total</strong></td>
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<td>82 total</td>
<td>233</td>
<td>2,126 hrs total 1,626 hrs AD</td>
<td>77% adherence rate to target</td>
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<td>32 in AD</td>
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<td>Patient preferences for scratch domains</td>
<td>Pediatric and Adult AD</td>
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FDA’s DDT Program Status for Scratch

- IRB-approved survey completed to assess most meaningful measure of scratch in AD patients for daytime vs nocturnal
- All clinical data already collected
- Update context of use, concept of interest in the QP (scratching at any time)
Conclusions

• To measure the symptom of itch, all three domains of skin appearance, patient perception, and patient behavior is important

• Measuring scratching as the defined behavior can be accomplished with a wide range of tools—wearables are the most common*

• Patients care about the entire spectrum of scratching behavior including scratch duration, scratch episodes, and scratch intensity for both daytime and nighttime periods

• Technologies that objectively measure scratching must be validated in well-conducted clinical studies

Digital Measurement Of Nocturnal Scratch: New developments

June 18, 11 a.m. ET
Processes, Validation, and Adoption
Public Workshop
Using Patient Generated Health Data in Medical Device Development: Case Examples of Implementation Throughout the Total Product Life Cycle

June 26, 2024 | 11am - 3pm ET
June 27, 2024 | 11am - 3pm ET