The novel application of artificial intelligence for the clinical assessment of complex alopecias

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Department of Dermatology
Disclosures

Grant Recipient: Pfizer Inc., Eli Lilly, National Alopecia Areata Foundation, Concert Pharmaceuticals, Inc.
Section Editor: Hair Diseases, UpToDate
Consultant: Cassiopea Inc., ASLAN Pharmaceuticals

The HairMetrix® device which will be discussed in this presentation was gifted by Canfield Scientific, Inc. to the Department of Dermatology at the University of Minnesota
Frontal Accentuation (Christmas Tree Pattern) in Female Pattern Hair Loss


- Normal density
- Patients with progressive stages of AGA/FPHL
• Hair loss is common.
• Hair regrowth is slow.
• Interval changes during treatment can be difficult for patients to appreciate.
• In this study, 119 surveys were completed by patients with androgenetic alopecia or a cicatricial alopecia who were undergoing treatment.
Results

• Before viewing comparative photos
  – 34.4% reported that their interval hair loss was “worse” or “much worse”
  – 81.5% reported alopecia-related anxiety

• After viewing comparative photos
  – 52.9% reported improvement in their alopecia
  – 81.5% reported decreased alopecia-associated anxiety
Hair loss is common.

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• HairMetrix, Canfield Scientific

• TrichoLAB Studio
A randomized, active- and placebo-controlled study of the efficacy and safety of different doses of dutasteride vs placebo and finasteride in the treatment of male subjects with androgenetic alopecia.

- Subject Self Assessment
- Investigator Assessment
- Independent Photo Review
35 Year History of Canfield in Hair Studies

**Objective Data**

A randomized, active- and placebo-controlled study of the efficacy and safety of different doses of dutasteride vs placebo and finasteride in the treatment of male subjects with androgenetic alopecia

**Objective Measure**

**Objective Data:**
- Non-Vellus Count
- Non-Vellus Width
- Vellus Count
- Vellus Width
- Darkness
The HairMetrix Solution

• Provides an AI-driven hair analysis
  – No hair clipping or hair staining required
  – Immediate analysis results available
### AI Measurement and Definitions

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair count per cm²</td>
<td>Number of hairs per follicular unit</td>
</tr>
<tr>
<td>Sum of hair width per cm²</td>
<td>Total scalp coverage</td>
</tr>
<tr>
<td>Terminal:Vellus ratio</td>
<td>Number of terminal hairs for every one vellus hair</td>
</tr>
<tr>
<td>Average hairs per follicular unit</td>
<td>Average number of hairs within a hair follicle</td>
</tr>
<tr>
<td>Average hair width (microns)</td>
<td>Average thickness of hair in microns</td>
</tr>
<tr>
<td>Follicle count per cm²</td>
<td>Number of follicles per square centimeter</td>
</tr>
<tr>
<td>Inter-follicular mean distance (mm)</td>
<td>Mean distance between follicular units</td>
</tr>
</tbody>
</table>

**AI photography device**

(Courtesy of Doug Canfield, President of Canfield Scientific Inc.)

15X - 200X magnification
How we collect AI data

- An electronic diagram is utilized to ensure measurement reproducibility.
- The blue circles represent specific locations where images are taken.
- The box stores information about image locations so that future images can be taken at the same sites.
Where we collect AI data

- Six different scalp regions:
  - Frontal anterior (FA)
  - Midscalp (M)
  - Vertex (V)
  - Occipital (O)
  - Right temporal (RT)
  - Left temporal (LT)
CCCA
Application of an artificial intelligence (AI) photographic device to track platelet-rich plasma treatment outcomes in females with alopecia

Presented at the 2021 Annual Meeting of the Society for Investigative Dermatology

Ora Raymond¹ BA, Gretchen Bellefeuille¹ BS, Ronda Farah¹ MD, Javed A. Shaik¹ PhD, Sam Esposito² BA, Maria Hordinsky¹ MD
Patient A-C PRP Flowchart

Patient A
- Baseline
- PRP session 1
  - 10/9/2020
- PRP Session 2
  - 1/8/2021
- PRP Session 3
  - 4/9/2021

Age: 50
Race: White
Diagnosis: Androgenetic alopecia

Patient B
- Baseline
- PRP session 1
  - 10/30/2020
- PRP session 2
  - 1/8/2021

Age: 43
Race: White
Diagnosis: Androgenetic alopecia

Patient C
- Baseline
- PRP session 1
  - 11/13/2020
- PRP Session 2
  - 1/15/2021
- PRP Session 3
  - 2/26/2021

Age: 31
Race: White
Diagnosis: Androgenetic alopecia
Mid scalp results - Patient C

(After 2 PRP treatments)
Frontal anterior results - Patient C

(After 2 PRP treatments)
Vertex results - Patient C

(After 2 PRP treatments)
TrichoLAB studio
for both clinical and trichoscopic assessment
Leviacam®

integrated polarized light
to see better
Leviacam®
13 Mpx

2,3 cm² Standard FOV
35 cm² Optional FOV

to see more
Virtual Tattoo®

to find the same spot again
Trichoscale AI
to assess hair instantly
H2H (hair-to-hair) Matching® technology for clinical trials and research to track each hair over the time of the study.
Summary

• Canfield Scientific
  – Technology allows patients the ability to review their results in real time.
  – Can compare timepoints and show before and after images to visually demonstrate treatment efficacy.
  – Can add global overview images.

• TrichoLAB Studio
  – Technology for clinical care, clinical trials and research.
  – Can focus on tracking each hair over time.
Hair Metrix Data

University of Minnesota
Department of Dermatology
Case 1: SS

- 45 yr old Female
- Hair loss- most consistent with androgenetic alopecia bx 1/22/2021 demonstrates noncicatricial alopecia
- Txt Hx:
  - Spironolactone 200 mg daily
  - 2% ketoconazole shampoo once weekly
  - Washes hair 1x/week, Aveda hair thickener 1x/week, Aveda hair styling product
  - Daily iron supplement for subclinical iron deficiency anemia
- Today, patient reports increased hair shedding since her last visit
- Compared to last visit, iPad photos show stable hair loss
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Frontal Anterior Scalp
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Mid Scalp
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Vertex
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Occipital Scalp
<table>
<thead>
<tr>
<th>Terminal/Velus Ratio</th>
<th>Occiput 2 right 1/22/2021</th>
<th>Occiput 2 right 7/19/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.3 : 1</td>
<td>87.0 : 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average hairs per follicular unit</th>
<th>Occiput 2 right 1/22/2021</th>
<th>Occiput 2 right 7/19/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>1.6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average hair width (µm)</th>
<th>Occiput 2 right 1/22/2021</th>
<th>Occiput 2 right 7/19/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.6</td>
<td>54.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Follicular units per cm²</th>
<th>Occiput 2 right 1/22/2021</th>
<th>Occiput 2 right 7/19/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>98</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inter-follicular mean distance (mm)</th>
<th>Occiput 2 right 1/22/2021</th>
<th>Occiput 2 right 7/19/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.36</td>
<td>1.20</td>
<td></td>
</tr>
</tbody>
</table>
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Right Temporal
<table>
<thead>
<tr>
<th></th>
<th>Temporal 1 right</th>
<th>Temporal 1 right</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1/22/2021</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal &gt; 90 μm</td>
<td>39</td>
<td>73</td>
</tr>
<tr>
<td>Intermediate 60 - 90 μm</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>Small 30 - 60 μm</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>96</td>
<td>122</td>
</tr>
<tr>
<td><strong>1/19/2021</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal &gt; 90 μm</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Small 30 - 60 μm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Terminal:Vellus Ratio**
- **1/22/2021**: 18.0 : 1
- **1/19/2021**: 69.0 : 1

**Average hairs per follicular unit**: 1.2 (1/22/2021) = 1.2 (1/19/2021)

**Average hair width (μm)**
- **1/22/2021**: 55.7
- **1/19/2021**: 62.9

**Follicular units per cm²**
- **1/22/2021**: 79
- **1/19/2021**: 104

**Inter-follicular mean distance (mm)**
- **1/22/2021**: 1.35
- **1/19/2021**: 1.18
Case 1: SS

Hair Metrix 1/22/21 compared to 7/19/21

Left Temporal
Case 1: SS

Plan Adjustments after Hair Metrix:

- Start derma-smoothe oil to scalp 1-2x/week
- Continue other treatments including:
  - Spironolactone 200 mg daily
  - 2% ketoconazole shampoo once weekly
  - Iron supplement
  - Vitamin D
Case 2: BG

- 63 yr old female
- Hair loss- diagnosed as LPP with contact allergy
- Txt Hx:
  - Previously treated with Clobetasol shampoo 0.05% and Ketoconazole shampoo 2%, alternating every other day
  - Received patch testing, which showed:
    - 2+ Nickel, cobalt, thimerosal, sorbic acid, Grotan BK, phenyl salicylate
    - 1+ fragrance mix, neomycin, shellac, benzoic acid, salicylic acid
    - +/- balsam of peru, ammonium persulfate, pramoxine, cetrimonium chloride, ketoconazole shampoo
  - Discontinued Ketoconazole shampoo; felt Clobetasol was worsening hair shedding diffusely
  - Briefly restarted Ketoconazole and saw different provider who noted her scalp looked “inflamed”
  - Discontinued Ketoconazole
- Today, patient feels stable to worsening hair loss
- Compared to last visit, iPad photos show stable hair loss
- After hair metrix, ciclpirox shampoo added with instructions to alternate every other day with clobetasol shampoo
Case 1: BG
Hair Metrix 3/29/2021 compared to 7/20/21
Results 1
Case 2: BG

Hair Metrix
3/29/2021 compared to 7/20/21
Case 2:
BG
Hair Metrix
3/29/2021 compared to 7/20/21
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Frontal Anterior Scalp
Case 1: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Frontal Anterior Scalp

<table>
<thead>
<tr>
<th>Color Key</th>
<th>3/29/2021</th>
<th>7/20/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 90 µm</td>
<td>35</td>
<td>29</td>
</tr>
<tr>
<td>60 - 90 µm</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>30 - 60 µm</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>&lt; 20 µm</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>113</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement</th>
<th>3/29/2021</th>
<th>7/20/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal:Vellus Ratio</td>
<td>1.2 : 1</td>
<td>2.9 : 1</td>
</tr>
<tr>
<td>Average hairs per follicular unit</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Average hair width (µm)</td>
<td>43.3</td>
<td>52.5</td>
</tr>
<tr>
<td>Follicular units per cm²</td>
<td>107</td>
<td>109</td>
</tr>
<tr>
<td>Inter-follicular mean distance (mm)</td>
<td>1.12</td>
<td>1.09</td>
</tr>
</tbody>
</table>
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Mid Scalp
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Vertex
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Occipital Scalp
Hair count per cm²

<table>
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<tr>
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<th>Occiput 1 left 7/20/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 90 µm</td>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>60 - 90 µm</td>
<td>59</td>
<td>75</td>
</tr>
<tr>
<td>30 - 60 µm</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>&lt; 30 µm</td>
<td>108</td>
<td>122</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Occiput 1 left 3/29/2021</th>
<th>Occiput 1 left 7/20/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal:Vellus Ratio</td>
<td>11.8 : 1</td>
<td>8.4 : 1</td>
</tr>
<tr>
<td>Average hairs per follicular unit</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Average hair width (µm)</td>
<td>66.7</td>
<td>67.1</td>
</tr>
<tr>
<td>Follicular units per cm²</td>
<td>71</td>
<td>92</td>
</tr>
<tr>
<td>Inter-follicular mean distance (mm)</td>
<td>1.40</td>
<td>1.25</td>
</tr>
</tbody>
</table>
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Right Temporal
Case 2: BG

Hair Metrix 3/29/2021 compared to 7/20/21

Left Temporal
Conclusions

- AI technology offers location specific hair fiber quantitative data which does not always require hair clipping or tattooing.
- AI data on terminal to vellus ratio can highlight early trends in determining treatment efficacy.
- AI technology can offer patients and physicians immediate objective information to assess treatment efficacy and scalp health.
- This is the future of alopecia clinical management.
Acknowledgements

• Canfield Scientific
  – Doug Canfield, Sam Esposito

• TrichoLAB Studio
  – Hubert Łącki
Thank you!

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