

Forensic Micropigmentation



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Forensics Definition:

The art or study of formal debate or argumentation.

forēnsis, meaning "of or before the forum." In Roman times a criminal case was settled in a public forum with both sides arguing their case

Forensic science is the gathering and examining of information and establishing facts in criminal or civil courts of law.

In science to investigate the past i.e. geology, astronomy

Tattooing

Intradermal implantation of indelible pigments and/or scarification of the skin to create legends, decorative art and symbolism for the purpose of body adornment.

Micropigmentation

Minute, metabolically inert pigment granules are placed mechanically/manually below the epidermis for the purpose of cosmetic and/or corrective enhancement.

aka: permanent makeup, cosmetic tattooing.

Dermal Biometrics (SMT)

BIOMETRICS

Biometrics -automated methods of recognizing a person based on an anatomical, physiological or behavioral characteristic or process.

Biological features or traits that can be measured include , fingerprints, DNA, iris, retina, whereas **Behavioral features** would include handwriting analysis and voice recognition.



Soft Biometric Traits:



Scars



Marks



Tattoos

Skin markings like scars, birthmarks and tattoos (SMT) are considered soft biometrics, easily measurable physical characteristics that can change (36% of people between 18 and 29 have tattoos).

Dermal Classification Systems:



Bertillon System

ANSI/NIST I-2000 Tattoo Classes	
Class description	Class code
Human Forms and Features	HUMAN
Animals and Animal Features	ANIMAL
Plants	PLANT
Flags	FLAG
Objects	OBJECT
Abstractions	ABSTRACT
Insignias & Symbols	SYMBOL
Other Images	OTHER

ANSI/NIST I-2000 Animal Tattoo Subclasses	
Subclass	Subclass code
Cats & Cat Heads	CAT
Dogs & Dog Heads	DOG
Other Domestic Animals	DOMESTIC
Vicious Animals (Lions, Tigers, etc.)	VICIOUS
Horses (Donkeys, Mules, etc.)	HORSE
Other Wild Animals	WILD
Snakes	SNAKE
Dragons	DRAGON
Birds (Cardinal, Hawk, etc.)	BIRD
Spiders, Bugs, and Insects	INSECT
Abstract Animals	ABSTRACT
Animal Parts	PARTS
Miscellaneous Animal Forms	MANIMAL

ANSI/NIST Tattoos

Zwerling Micropigmentation Procedural Classification System	
I. COSMETIC <i>Permanent makeup procedures that are performed to mimic conventional makeup</i>	II. CORRECTIVE <i>Paramedical procedures that are performed to correct diseases and/or deformities</i>
A. Eyes 1. Eyeliner 2. Eye lash enhancement 3. Eye shadow	A. Simulation 1. Hair loss due to disease (i.e. alopecia or trauma); treatment: eyelashes, brow hairs, scalp, etc. 2. Cornia: create appearance of an iris and pupil 3. Nails: create appearance of painted toenails or fingernails 4. Breast: create artificial areolar complex following breast cancer reconstruction
B. Eyebrow 1. Eyebrow liner 2. Eyebrow hair enhancement	B. Camouflage 1. Vitiligo: Counter-tattooing vs. postillumination 2. Port wine stain 3. Skin hypo/hyperpigmentation as a result of disease or injury (MCA) 4. Scalp shading
C. Lips 1. Lip liner 2. Full lip pigmentation	C. Revision 1. Disease: scars, depressed scars (i.e. pitted acne scars) 2. Trauma: burns 3. Surgery: post-traumatic and/or elective correction
D. Breast Areolar pigmentation enhancement	D. Resurfacing 1. Wrinkles a. aging b. sun damage 2. Microdermabrasion; stretch marks
E. Facial 1. Blush 2. Beauty marks	E. Medical Marker Use of placing permanent pigmented marks in an area being treated for cancer in order to allow the oncologist to be able to re-biopsy the exact area of the original malignancy

Micro Classification



Human



Animal



Plant



Flag



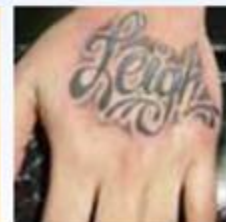
Object



Abstract



Symbol



Other

Zwerling Micropigmentation Procedural Classification System

I. COSMETIC

Permanent makeup procedures that are performed to mimic conventional makeup

A. Eyes

1. Eyeliner
2. Eye lash enhancement
3. Eye shadow

B. Eyebrow

1. Eyebrow liner
2. Eyebrow hair enhancement

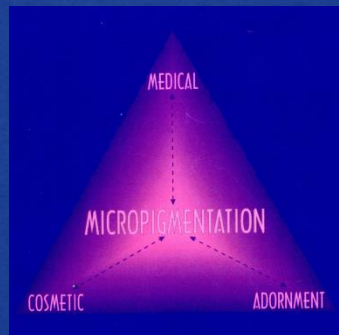
C. Lips

1. Lip liner
2. Full lip pigmentation

D. Breast Areolar pigmentation enhancement

E. Facial

1. Blush
2. Beauty marks



II. CORRECTIVE

Paramedical procedures that are performed to correct diseases and/or deformities

A. Simulation

1. Hair loss: due to disease (i.e. alopecia or trauma); treatment: eyelashes, brow hairs, scalp, etc.
2. Cornea: create appearance of an iris and pupil
3. Nails: create appearance of painted toenails or fingernails
4. Breasts: create artificial areolar complex following breast cancer reconstruction

B. Camouflage

1. Vitiligo: Countertattooing vs. pointillism
2. Port wine stain
3. Skin hypo/hyperpigmentation as a result of disease or injury (MCA)
4. Scalp shading

C. Revision

1. Disease: scars, depressed scars (i.e. pitted acne scars)
2. Trauma: burns
3. Surgery: post-traumatic and/or elective correction

D. Resurfacing

1. Wrinkles
 - a. aging
 - b. sun damage
2. Microdermabrasion: stretch marks

E. Medical Marker

Use of placing permanent pigmented marks in an area being treated for cancer in order to allow the oncologist to be able to re-biopsy the exact area of the original malignancy

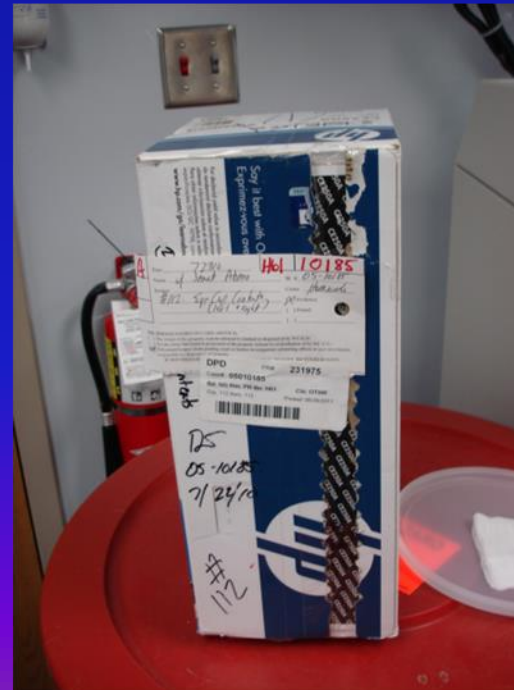
Overview:

- Collect Evidence & Exam
- Morphology
- Physical Properties
- Zwerling Micropigmentation Procedural Classification System
- Data Base
- Simulation Studies

Identification of Samples

Collect Evidence:

1. Exam Identify and record location of sample.
i.e. right lower eye lid.
2. Chain of evidence documentation.
3. Use of digital photography for documentation throughout entire forensic examination.

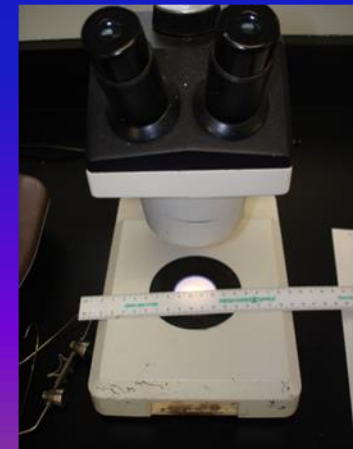
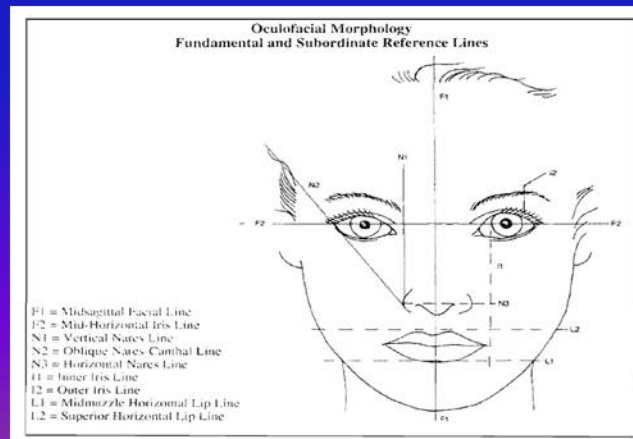
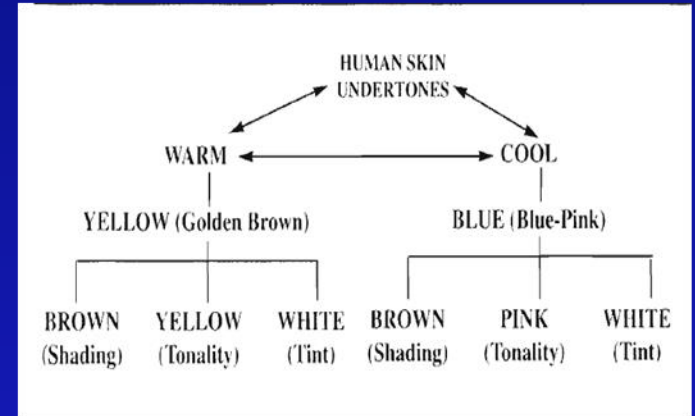


Morphology

Classification Systems

(5-S Zwerling-Christensen & Oculo-Facial Morphology)

1. **Size:** measure in metric with calipers/ rulers.
2. **Shape:** irregular, random or consistent lines and/or patterns.
3. **Weight:** in grams metric.
4. **Color(s):** use color key to assist in description; (Fitzpatrick Scale 1-6).



Physical Properties

1. Macro evaluation

a. Distinctive artistic technique/ style “CLIMB” artistic technique:

Color, Line, Insertion, Movement, Borders

i. Pointillism

ii. brush stroke

iii. dimensional use of color:

b. Mechanism of pigment placement

a. reciprocal conventional tattoo machine

b. rotary micropigmentation machine

c. Hand technique

c. Determination of possible needle type

a. liners

b. shaders

c. magnums

C-Color

L-Line

I-Insertion

M-Movement

B-Borders

Physical Properties



- **Micro evaluation or Histology**
 - a. Amount and Depth of pigment and uniformity of depth
 - b. Collagen reaction / Stage of Healing: Phase 1-4
 - c. Migration effects localized directional age of pigmentation
 - d. Cellular removal and/or lymphatic; cellular type histiocyte,
 - e. Presence of needle tracks/injections ; Dry Needling
- **Magnetic Properties**
 - a. +/- presence of ferrous/ferric pigment
- **Chemical Composition pigment by gas mass spectrometry**
 - a. Organic: carbon nitrogen oxygen chlorine, hydrogen
 - b. Inorganic: iron oxide, titanium, presence of talc
- **Water Properties:**
 - a. hydrophilic
 - b. hydrophobic
- **Infra-Red Photography: reveal hidden pigmentation**
 - a. used to visually recover underlying tattoos from cover tattoo designs
 - b. used to reveal previous micropigmentation that has been camouflaged
 - c. used to reveal tattoo/micropigmentation designs (removed by laser).

Data Base

Use of **electronic medical records (EMR)**

- Correlate pigment brand with a specific patient.
- Identify permanent makeup practitioner.

Identify specific **manufacturer** based on chemical composition

- Develop baseline analysis of commercial pigments by published composition.
- Use of gas mass spectrometry.

Scale Invariant Feature Transform

- Extract **distinctive** features from images to match between different views of an object
- **Invariant** to image scale & rotation; **robust** to distortion, view point, noise & illumination



Lowe, D.G., *Object Recognition from Local Scale-Invariant Features*, ICCV99 (1150-1157)

Data Base

Tattoo-ID

- Use of University of Michigan MorphoTrak System.
- This technology uses features such as tattoo color, shape and texture to compute the similarity between images and was developed by Dr. Anil K. Jain.
- (SMT) Scar Mark Tattoo in cooperation with the Michigan State Police Identification Section.

Tattoo Matching: Current Practice

- Find similar tattoos based on **class labels**
- ANSI/NIST labels are not precise: "**Abstract**" class
- Same tattoo image can have multiple labels



All these 12 tattoos belong to the FLAG category

Content-Based Image Retrieval

How should we tag this image?

→ Boat, sunset, cruise, fisherman,...



- Keywords do not express **image semantics**
- **CBIR**: search the database using the similarity of **visual features**: color, texture, and shape
- Applications: medical imaging, personal photo collection, art galleries and museums,.....

Simulation Studies

- Reproduce physical environment.
- Reproduce physical conditions.

Forensic Micropigmentation:

E. Expert Witness

1. Expert Witness: by virtue of education, training, skill, or experience, is believed to have expertise and specialized knowledge in a particular subject beyond that of the average person, sufficient that others may officially and legally rely upon the witness's specialized (scientific, technical or other) opinion about an evidence or fact issue within the scope of his expertise
2. Non Testifying Expert: help attorney evaluate merits of a case; not open to discovery
3. Testifying Expert: Fed. R. Evid. 702.[1] Generally, under Rule 702, an expert is a person with "scientific, technical, or other specialized knowledge" who can "assist the trier of fact," which is typically a jury. A qualified expert may testify "in the form of an opinion or otherwise" so long as:
 - (1) the testimony is based upon sufficient facts or data,
 - (2) the testimony is the product of reliable principles and methods, and
 - (3) the witness has applied the principles and methods reliably to the facts of the case.

All evidence by expert is open to discovery

AAM CFME® Program

Certified Forensic Micropigmentation Expert®

American Legal System

In the courtroom environment, experts in various fields are asked to provide testimony and evidence on differing professional topics. Forensic consultants will be assessed on knowledge and competency in areas relating to consultation services, litigation processes, general legal principles, witness payment, the discovery process, the deposition, and the trial.

The AAM CFME® Credential

The Certified Forensic Micropigmentation Expert, CFME® program will help prepare the forensic professional with the necessary knowledge and information to successfully testify in court in a professional manner.

Benefits of becoming a Certified Forensic Micropigmentation Expert, CFME®

- Grants recognition of knowledge and skills by a third party
- Supports continued professional development
- Demonstrates a high level of commitment to the field
- Serves as a differentiator in a competitive job market

Credential Content The domains covered in the CFME® are as follows:

- Federal rules in civil proceedings
- The deposition process
- Interrogation methods
- Trial themes and strategies
- Appropriate file sharing techniques and etiquette
- Fee establishment

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