Bitemark Analysis

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The Problems

• The uniqueness of the human dentition
• The ability of teeth (if unique) to transfer a unique pattern to human skin

• Standards
  • Experience required to apply for certification
  • Peer review and second opinions
  • Proficiency testing
  • Threshold of evidentiary value for patterned injuries

• Techniques, Technology, and Statistics

• Bias and Ego

• Problem Cases
The Uniqueness of the Human Dentition

• “Everyone’s teeth are different”
• Published studies
  • Sognnaes et al, 1982
  • Rawson et al, 1984
  • Kieser et al, 2007
• How do we measure those differences?
• Statistical analysis
Reported Studies


“in terms of occlusal arch form and individual tooth positions, even so-called identical twins are in fact not dentally identical.”
Reported Studies


“This mathematical evaluation of a general population sample demonstrates the uniqueness of the human dentition beyond any reasonable doubt, thus placing the odontologist's statements about individuality beyond the realm of theory and into the realm of supported fact.”
The Product Rule

The probability that two or more independent events will occur is equal to the product of their individual probabilities.

\[ \frac{d}{dx} \left[ \prod_{i=1}^{k} f_i(x) \right] = \sum_{i=1}^{k} \left( \frac{d}{dx} f_i(x) \prod_{j \neq i} f_j(x) \right). \]
Reported Studies

Kieser, et al

• “…suggest a low, non-significant level of correlation between dental size/shape and arch shape”

• “…the product rule can be applied to the assessment of these data”

• “it appears that the incisal surfaces of the anterior dentition are in fact unique.”
Skin

Problems with human skin as a faithful medium for impression evidence

- Viscoelasticity
- Langer Lines
- Distortion
- Bruises
- Abrasions
- Depressions
Langer Lines
Published Studies

  
  • Cadaver model
  
  • Two dimensional analysis
“...the result of this study suggests that an open population postmortem bitemark should be carefully and cautiously evaluated particularly if limited exclusively to two-dimensional overlay comparison. This is due in part to distortion and loss of resolution in the transference of arch and dental characteristics to skin.”
Standards

• New Forensic Odontologists have too little experience in bitemark analysis
• There is no requirement to seek second (or third) opinions in bitemark cases
• There is no mandatory proficiency testing for certified forensic odontologists.
Techniques and Technology

• 2D vs. 3D analysis
• Importance of distinctive individual characteristics
• Microscopy
Bias and Ego

- Confirmation Bias
- Cognitive Biases
  - Egocentricity
  - Beneffectance
  - Cognitive Conservatism

“The ego is a self-justifying historian, which seeks only that information that agrees with it, rewrites history when it needs to, and does not even see the evidence that threatens it.”
<table>
<thead>
<tr>
<th>Problem Cases</th>
<th>Year</th>
<th>Location</th>
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<tbody>
<tr>
<td>Torgersen</td>
<td>1958</td>
<td>Norway</td>
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<td>Milone</td>
<td>1976</td>
<td>Illinois</td>
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<td>Wilhoit</td>
<td>1987</td>
<td>Oklahoma</td>
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<td>Krone</td>
<td>1992</td>
<td>Arizona</td>
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<tr>
<td>Brewer</td>
<td>1992</td>
<td>Mississippi</td>
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Problem Cases-Torgersen accused of murdering Rigmor Johnsen
Problem Cases-Torgersen

Johnsen Bitemark

Bitemark with good evidentiary value
Bitemarks
with good evidentiary value
Problem Cases-Krone
accused of murdering Kim Ancona

Ancona Bitemark  Bitemark with good evidentiary value
Bitemarks with good evidentiary value
Problem Cases-Brewer
accused of murdering Christine Jackson
Problem Cases-Brewer
West Video Examination
NAS Conclusions

• ...it is reasonable to assume that the process can sometimes reliably exclude suspects.
• Scientific Studies do not support odontologists’ theories that bitemarks can be used for positive identification
• Experts diverge in evaluation of the same bitemark
• Research is warranted to identify how the methods can provide probative value.
Actions by ABFO

• Institute a required recertification test for all ABFO certified forensic odontologists (Approved February 2009 – effective 2010)

• Increase the bitemark case experience required to apply for certification from 2 to 7 cases (Approved February 2010 - effective 2012)
Actions by ABFO

- Require peer review and 2\textsuperscript{nd} Opinions (Currently in development)

- Modify terminology relating suspected biters to bitemarks (effective 02/22/2010)
Terminology

Before 2/2010
Terms relate bitemark to suspected biter

- Reasonable Dental/Medical Certainty
- Probable
- Exclusion
- Inconclusive

After 2/2010
Terms relate suspected biter to bitemark

- The biter
- The probable biter
- Not excluded as the biter
- Excluded as the biter
- Inconclusive

All terms stated to reasonable degree of dental certainty
Opinions

Bitemark analysis is too valuable to the investigation and adjudication of certain crimes to be abandoned, discounted, or overlooked.

The use of bite mark analysis to exclude suspects is powerful and important.
Opinions

The scientific basis for associating suspected biters to tooth marks or bitemarks must be established.

For a bitemark on human skin, the opinion characterizing a suspected biter as “the biter” to a reasonable dental, medical, or scientific certainty, based on pattern analysis alone, cannot be scientifically supported.
Competent Forensic Odontologists

Are capable of using all known evidence collection and comparison modalities and use those that are appropriate for the case in question.

Employ blinding and other techniques to inhibit bias and observer effects in all phases of their work.
Competent Forensic Odontologists

Seek second or multiple second opinions from other independent, blinded, competent forensic odontologists.

Engage in continuous study and research to improve themselves and forensic odontology.
Competent Forensic Odontologists

Recognize and abide by appropriate Codes of Ethics and Conduct.

Understand the scientific method and use the method in tests and procedures to the greatest extent possible.
The Future of Bitemark Analysis

The future of bitemark analysis depends upon those forensic odontologists who have impeccable ethics combined with protocols, procedures, and opinions firmly rooted in science, and their egos in check.

They must have committed to continuously study, experiment, and learn. And if called upon to do so, they must have the vision, energy, and courage to make necessary and difficult changes.
Recommended Text

Forensic Dentistry,
2nd Edition
Senn, D.R. and P.G. Stimson
2010,
Taylor & Francis/CRC Press
Recommended Text

Bitemark Evidence
Dorion, R.B.J.
2004
Taylor & Francis/CRC Press

2nd Edition in late 2010
Thank You
Litigating Non-DNA Bitemark Cases

Vanessa Potkin, The Innocence Project
Byron Lichstein, Wisconsin Innocence Project
Classic CSI Identification

- Brutal, often sadistic crimes
- Often no direct evidence of who did it
- Forensic odontologist: highly educated scientific expert using specialized, complex methodology
Claims of Conclusive Identification

- Teeth “match” the bites
- Bites “could only have been made by” defendant
- Exaggerated/speculative probability statistics
- “science” + expert’s certainty = extraordinarily convincing evidence to lay jury
Proven Errors

• DNA evidence has conclusively disproven forensic odontologists in a number of cases

• What caused these mistakes?
What can bitemark ID really show?

• In some cases, it can exclude a suspect
  – Unique dental characteristic (ie missing tooth)
  – Full, high quality bite patterns
  – If unique characteristic is absent from high quality bitemark evidence, then exclusion can be legitimate
What can bitemark ID really show?

- Cannot conclusively ID or match a suspect to a bite
  - No empirical data proving that people’s teeth leave unique marks in skin
  - No empirical data that analysts can accurately match teeth to marks
What can bitemark ID really show?

- Claims of “match” or conclusive identification are scientifically unfounded.
- Testimony about “similarities” between teeth and bites is dubious as well, because such testimony is difficult to evaluate without statistics concerning whether other teeth are also “similar”.
Screening a non-DNA bitemark case

• Things to look at while screening:
  – Expert’s claimed level of certainty
  – Method expert used
  – Process leading to expert’s analysis
    • how expert became involved
    • how suspect became a suspect
    • what other evidence expert was aware of
  – Expert’s background
Screening a non-DNA bitemark case

• Get all the data underlying the bitemark analysis
  – Roy Brown
• Don’t forget to consider possibility of DNA testing
Litigating a non-DNA bitemark case

• Theories of innocence
  – It’s not a human bitemark
  – It’s a human bitemark, but my client’s teeth can be excluded
  – It’s a human bitemark, but there’s no way of saying my client’s teeth made it
Litigating a non-DNA bitemark case

• Get independent expert opinion on your evidence
  – New analysis w/ modern method
  – If State claimed a match, ask expert if other model teeth might also match
  – Other kinds of scientific experts
    • Brewer
  – Peer review panel
    • meeting w/ State’s expert
Litigating a non-DNA bitemark case

• Challenge the general lack of science in bitemark ID
  – Expert on scientific process who can compare bitemark ID to other sciences
  – NAS report
  – Frye/Daubert challenges to specific aspects
Litigating a non-DNA bitemark case

• Can do both a new analysis and a challenge to the science
  – New analysis excluding client
  – Fallback position that inclusion scientifically invalid
Litigating a non-DNA bitemark case

• Typical challenges/impeachment for opposing expert witnesses
  – Role in other wrongful convictions
  – Exaggerations in resume
  – Inconsistent statements in publications
  – Professional discipline
References: Bitemark Exonerations

- **Burke v. Town of Walpole:**
  - Individual arrested based on bite mark identification sued for false arrest after DNA tests excluded him. 405 F.3d 66, 73 (1st Cir. 2005)

- **Florida v. Morris:**

- **Dan Young:**
  - Twelve years after being convicted based on testimony from a forensic odontologist purportedly linking Young to a bite mark on the victim, prosecutors agreed to a new trial and dropped all charges after DNA testing excluded Young. *12 Years Behind Bars, Now Justice at Last* (Chicago Tribune, Feb. 1, 2005)
References: Bitemark Exonerations

• *State v. Otero*
  – Forensic odontologist testified at a preliminary examination that Otero was "the only person in the world" who could have inflicted the bite marks at issue. After spending five months in jail awaiting trial, the State dismissed the charges after a newly available DNA test excluded Otero as the source of DNA on the victim. *Otero v. Warnick*, 241 Mich. App. 143 (Mich. Ct. App. 2000);

• *State v. Krone:*
  – After being sentenced to death, Krone served over a decade in prison before DNA testing led to his exoneration and the indictment of another man. The State acknowledged that Krone was convicted principally upon the opinion testimony of a forensic odontologist who stated that "the teeth of Ray Krone did cause the injuries on the body of Kimberly Ancona to a reasonable medical certainty. This represents the highest order of confidence that no other person caused the bite mark injuries." *Senator Helped Send Innocent Man to Death Row* (Las Vegas Rev. J., Nov. 30, 2003).
References: Bitemark Exonerations

- Willie Jackson (Louisiana)
- Calvin Washington (Texas)
- James O’Donnell (New York)
- Robert Lee Stinson (Wisconsin)
- Kennedy Brewer (Mississippi)
- Roy Brown (NY)
References: Scientific Research


• M. Saks & J. Koehler, *The Coming Paradigm Shift in Forensic Science*, 309 *Science* 892, 893, Fig. 2 (Aug. 5, 2005)
