

Committee remarks for additional content from Drs. Wood and Wright in this second submission of their feedback are added in green below.

AMERICAN BOARD OF FORENSIC ODONTOLOGY (ABFO)

Standards and Guidelines for ~~Pattern Evidence, Patterned Injury Evidence, and Bitemark Evidence~~

Preface

ABFO standards and guidelines are dynamic and can be modified in response to developments in the field following ABFO policies and bylaws. These standards and guidelines were developed with consideration of the current evolution what is the current evolution? When did it last evolve and how has it changed. This have no meaning. of the discipline. The appendices to this document include a Glossary of Terms (Appendix 1), lists of potential Uses of Bitemark Evidence (Appendix 2), and checklists for specific procedures (Appendices 3, 4, and 5)

1. Standards

- a. ABFO Diplomates shall be familiar with and adhere to ABFO Standards.
- b. An ABFO Diplomate shall (where that evidence is available) document, review, and consider all evidence provided to the Diplomate and all evidence collected, produced, or requested and received by the Diplomate.
- c. ABFO Diplomates shall be familiar with and use established analytical methods for pattern, patterned injury, and bitemark evidence. These can be supplemented with other techniques or methods.
- d. Final reports shall include the results of all analyses.
- e. Terms used in a manner different from the guidelines shall be explained in reports and in testimony.
- f. ABFO Diplomates shall not express conclusions unconditionally linking a bitemark to a dentition.
- g. An ABFO Diplomate shall not give expert testimony outside her/his recognized area(s) of expertise.

2. Guidelines

a. Guiding Principles

i. Objectivity

Odontologists should remain objective in all phases of investigation, analysis, comparison, and reporting of their casework. (See Appendix 1). There is not mention of bias in this appendix which directly effects objectivity in countless ways. In fact, a word search for the term "bias" in this

Formatted: Strikethrough

Commented [RW1]: We have no business opining on subject areas (patterns) outside of bitemarks.

Commented [RW2]: Okay if bite marks and their analysis are considered to be a dynamic subject then we shouldn't be using language like "shall." I could interpret "dynamic" to mean I can change them these guidelines on a whim.

Commented [RW3]: What would "current evolution" be – multiple wrongly convicted people being set free after years of incarceration due to errant bite mark comparison OR pending cases where people may be set free and odontologists found wanting: OR would it be the Texas Forensic Sciences commission not allowing bite mark evidence? OR would it be the profession being held out to public ridicule by late night comedians (John Oliver)?

Commented [RW4]: You JUST SAID they are dynamic and can be modified yet "shall" is one of the strongest words in law.

Commented [RW5]: See above re dynamic vs shall

Commented [RW6]: Ditto and how does one who SHALL conform to the guidelines at the same time tell how he SHALL NOT/HAS NOT CONFORMED to them I would substitute the word "must" for "shall."

Commented [RW7]: So the word "include" should be tossed in favor of "cannot exclude – as used by the NIST committee.

Commented [RW8]: Then I think it would be best if we left "pattern injuries" to the forensic pathologists and stuck to bitemarks.

Commented [RW9]: One can be objective and be biased without even knowing that they are biased. I believe we need an ENTIRE APPENDIX ON THE VARIOUS TYPES OF BIAS AND THAT BIAS ITSELF BE INTRODUCED AT THIS JUNCTURE AND THAT ODONTOLOGISTS BE FAMILIAR WITH THE TYPES OF BIAS. SEE https://en.wikipedia.org/wiki/List_of_cognitive_biases

document finds ZERO hits.

ii. THE NATURE AND SOURCES OF BIAS AND POTENTIAL BIAS

iii. Nature, Value, and Limitations of Bitemark Evidence

Formatted: Normal, Left, Indent: Left: 2.78 cm, No bullets or numbering

Formatted: No underline, Character scale: 100%

Odontologists should discuss and explain the nature, value, and limitations of bitemark evidence with investigative and legal authorities involved, including the relationship of the bitemark evidence to other physical evidence. How is an odontologist supposed to know the relationship of BMs to other physical evidence?

iv. Blinding

~~1) Whenever possible, the same odontologist should shall not collect evidence from both persons with patterned injuries purported to be bitemarks and persons of interest whose dentitions may or may not have caused the bitemark. Another dentist should be engaged to collect such evidence.~~

2) When only one person of interest is proffered As the potential biter or person bitten or part of the "relationship to the BM evidence?", the odontologist can engage another dentist to produce a "dental line-up" of dentition evidence. What if a potential biter is edentulous and rugae are used for a comparison? Rugae or lip prints are not dentition If utilized, the dental line-up evidence should include evidence from the person or persons of interest and from other individuals as foils. (see Foil in Appendix 1)

The dental line-up evidence should be similarly produced, developed, and presented to avoid disclosing identifying information. Is this a bias issue?!

- a) A minimum of three (3) foils should be included in the dental line-up evidence for single person of interest cases. Why "3"? Is two too few. It may difficult if not impossible to find "like" foils for any of a number of profoundly unique dentitions such that "3" similar foils isn't possible- see item C below
- b) There should be no gross discrepancies in the general arrangement and number of teeth present for selected foils. For example, if the dentition of a person of interest displays a midline diastema, foils should include dentitions with midline diastemata.
- c) Dental casts for dental line-up evidence should be selected considering similarities in: Doesn't this say the same thing as item C above?
 - i) Teeth present or missing
 - ii) Overall and arch characteristics
 - iii) Dental characteristics

3) When multiple persons of interest are proffered, the odontologist can include one or more foils to supplement the dental line-up. Unless, of course there are already three proffered

4) When comparing dentition evidence and bitemark evidence, the odontologist making the comparison ~~should shall~~ ("should" leads to a

Commented [RW10]: MAYBE WE SHOULD REFER THEM TO THE IP (THE REAL ONE) OR TO THE TEXAS FORENSIC SCIENCE COMMISSION?

Formatted: Strikethrough

Formatted: Strikethrough

Commented [RW11]: THE SHOULD AND THE SHALLS SHOULD (OR SHALL) BE INTERNALLY CONSISTENT WITHIN THIS DOCUMENT.

Formatted: Strikethrough

Formatted: Strikethrough

Deleted: ¶

Formatted: Character scale: 100%

Formatted: Strikethrough

Formatted: Normal, Indent: Left: 3.01 cm, Right: 0.21 cm, Space Before: 4.95 pt, Line spacing: Multiple 1.05 li, Tab stops: 4.01 cm, Left

Commented [RW12]: We can never know whether it is a single person or not.

Formatted: Left, Indent: Left: 5.01 cm, No bullets or numbering

Commented [RW13]: 3 may be insufficient – there is no empirical evidence showing that 3 is adequate. We pulled that number out of our backsides. Additionally the work of Bush et al would say you need more than three. Having three people is not a "research study" it is a "test." A test is not a study – they are two different animals.

Commented [RW14]: When this is done you are not in possession of a control group and further you have now introduced another selection process and one might argue another source of error or bias. What you seem to be saying is that you are looking for people with "sorta" the same teeth but REALLY the same dentition. This is a selection process and it has to be described and this selection has to be justified. It is neither in this document.

Formatted: Strikethrough

bias) not have access to dentition information disclosing the identity of a person of interest. All comparison dentition evidence within the dental line-ups should (surely you mean SHALL?) be anonymized. Another redundancy – see the preceeding sentence

v. Independent Verification

- 1) Before submitting a final report excluding (*excluded*) or including (*not excluded*) a dentition as having caused a bitemark, odontologists Why redundant terms- either use the official terminology or the generalization of include or exclude but not both since the italicized terms are not yet defined in this document.

Commented [RW15]: NOT EXCLUDED AND INCLUDED ARE NOT THE SAME THING. IF YOU LOOK AT THE BUSH STUDY – SEVERAL DENTITIONS COULD NOT BE EXCLUDED FROM HAVING MADE AN EXPERIMENTAL BITE MARK HOWEVER TO SAY THE SUBJECT DENTITION IS "INCLUDED" MEANS TO 12 LAY PEOPLE IN A JURY, THAT THE **INDIVIDUAL DEFENDANT IS INCLUDED IN THE POSSIBLE PERPETRATORS. THE IMPORTANCE OF THIS CANNOT BE OVER-STATED. IF YOU SAY A PERSON IS INCLUDED YOU ARE TELLING THE TRIER OF FACT THAT **THE PERSON WHOSE TEETH YOU HAVE IS WITHIN THE GROUP OF SUSPECTS WHO DID THIS (PRESUMABLY) HORRIBLE CRIM. THIS IS HIGHLY PREJUDICIAL.****

~~should~~ shall seek independent verification in the form of a second opinion from a minimum of one ABFO Diplomate. See the Texas Forensic Science Commission comments for acceptability of BMs if their suggested ban is to be modified.

Formatted: Strikethrough

- 2) Odontologists engaged for independent verifications ~~should~~ (SURELY THIS IS ANOTHER PLACE WHERE THE WORD "SHALL" SHALL BE USED. be blinded to the conclusions of the referring odontologist and blinded to information that would reveal identifying information regarding persons of interest.

Commented [Office16]: THIS IS A CRITICAL PLACE WHERE THE WORD "SHALL" IS REQUIRED. THERE IS NOTHING MORE IMPORTANT THAN BLINDING. This is a guideline, so it is a recommendation not a standard.

b. Terms indicating a pattern or patterned injury is or is not a bitemark

i. Human Bitemark – human teeth caused the pattern

Criteria: The pattern demonstrates class characteristics of human teeth, including prosthetic replacements when present. The discernable features are of sufficient quality that other causes for the pattern were considered unlikely or ~~excluded~~.

Commented [RW17]: I THINK IT MIGHT BE GOOD TO HAVE SOME PHOTOS HERE.... OR ACTUAL THINGS LIKE DIMENSIONS AND FEATURES IN COMMON THAT WE ALL COULD AGREE SHOULD BE FOUND IN A BITEMARK ON SKIN,

(See Human Bitemark description at 2.d.ii.)

As the Freeman- Pretty-Senn study showed, a restrictive definition of characteristics to definitively identify a pattern or patterned injury as a bitemark that must be present is foundational if a pattern or patterned injury is to be definitively identified as a human bitemark. This definition and the "Human Bitemark description at 2.d.ii contain no such requirements. The definition above loosely describes what a bitemark may look like (but other patterns or patterned injuries could contain similar appearances) and the 2.d.ii list is organized such that the investigator could choose to identify one or two or even three perhaps of the descriptors listed and call a pattern or patterned injury a BM while ignoring all the other features present in the pattern or patterned injury that are not identifiable as descriptors of bitemarks. Cases from West, Warnick and others fell victim to exactly this approach to defining a pattern or patterned injury as a bitemark which was later proven to be an erroneous proclamation. In the "evolution of BM evidence" as presented here, the past WILL be repeated and this loose definition of a bitemark will be a cause.

Commented [RW18]: I COMPLETELY CONCUR WITH FRANK HERE.

- ii. Possible Human Bitemark – the pattern or patterned injury contains certain characteristics of a human bitemark but the evidence does not support a more definitive conclusion. These patterns can contain investigative or evidentiary information of value but should not be used for comparisons.

Commented [RW19]: This idea needs to be aborted prior to its birth. If you cannot say that it is definitively a bite mark you have zero business saying anything about it.

Criteria: The shape, size, and constituents of the pattern are generally consistent with a human bitemark but:

- While arch configuration information is visible, individual tooth marks or other features can be missing, incomplete, distorted, or deficient, and/or
- Indications of individual tooth marks are present but arch configuration information can be inadequate, incomplete, distorted, or missing.

- iii. Not a Human Bitemark – human teeth did not cause the pattern

Criteria: The pattern or patterned injury does not possess contain features demonstrating the class characteristics of human teeth.

- iv. Inconclusive – There is insufficient information available to support a conclusion of whether or not a pattern or patterned injury is a human bitemark.

~~Criteria: Features demonstrating the class characteristics of human teeth are missing, incomplete, distorted, or otherwise insufficient. Inconclusive and possible are the same thing – ditch possible – it is the road to hell that is paved with good intention.~~

Formatted: Strikethrough

Formatted: Not Strikethrough

- c. Terms relating or linking a dentition to a human bitemark

- i. Excluded as Having Made the Bitemark

Criteria: The bitemark demonstrates class characteristics or individual

characteristics that could not have been caused by the dentition.

ii. Not Excluded as Having Made the Bitemark

Criteria: The bitemark demonstrates class characteristics or class and individual characteristics that could have been caused by the dentition. There are no unexplainable discrepancies between the features of the bitemark and the dentition. The dentition of interest or a dentition similar to it cannot be excluded as having made the bite mark. Further we do not know how similar different dentitions need to be - to leave similar bite marks. OR conversely can the same dentition leave different bite marks.

Deleted: -The dentition is included in the population of dentitions that could have caused the bitemark

Formatted: Strikethrough

Deleted: .

iii. Inconclusive

Criteria: There is insufficient information to support a conclusion whether or not the bitemark could have been caused by the dentition.

d. Bitemark: Definition, Characteristics, Descriptions, and Evidentiary Value

i. Bitemark definition

A physical alteration or representative pattern recorded in a medium caused by the contact of the teeth of a human or animal.

ii. Human bitemark description ~~SEE COMMENTS BELOW IN RED...~~

Deleted: See my comments above in item b.

1) A curvilinear pattern or patterned injury generally circular or oval and almost always consisting of two opposing arches or partial arches that may or may not be separated at their bases. Sometimes only one arch is clearly visible.

Deleted: often

Deleted: by unmarked space.

Commented [RW20]: Enjoy these single arch bite marks on your way to civil court.

2) Individual marks, impressions, abrasions, contusions, striations, or lacerations from specific teeth may be found within the pattern.

3) A central area of contusion may or may not be present.

Deleted: is sometimes

4) In severe human bitemarks material may be forcefully removed from the medium bitten.

5) The marks present reflect the size, shape, arrangement, and distribution of the contacting surfaces of teeth with clearly identifiable midlines and dimensions between (give the smallest conceivable useful bite mark dimensions and the largest - somewhere between a star-nosed shrew and H.R. Pufnstuff.

Deleted: .

6) The contacting surfaces of human teeth include incisal and occlusal surfaces of teeth and may include lingual surfaces of anterior teeth.

Deleted: the

Deleted: also

Deleted: the

7) The size and shape of each visible arch conforms to the varying ranges of size and shape of the human dentition. GIVE THEM

iii. Characteristics of human bitemarks

1) Class characteristic

A feature, trait, shape, or array that distinguishes a bitemark from other patterns or patterned injuries. An expected finding within a class or group. I think this should be more clearly defined.

Deleted:

2) Individual characteristic

A feature, trait, shape, or array that represents an individual variation within a group rather than an expected finding within that group. This will need to be explained to most people more clearly.

a) Arch characteristic

An arch characteristic is a type of individual characteristic that is displayed in a pattern representing the arrangement of multiple teeth in a dentition or bitemark. (e.g. arch shape, arch size, rotated teeth, teeth displaced toward the facial or lingual, teeth drifted toward the mesial or distal, diastemata). Identifiable midline too perhaps? Definitely an identifiable midline.

b) Dental characteristic

A dental characteristic is a type of individual characteristic seen in a bitemark that represents an individual tooth variation (e.g. wear pattern, chips, notches, fractures, dental anomalies). I would have thought rotated teeth and displaced teeth etc etc would be dental characteristics and in any case this whole paragraph should be "individuating characteristics."

COMMITTEE WISHES TO DRAW TO THE READERS' ATTENTION THAT THIS TEXT WAS IN THE ORIGINAL FEEDBACK FROM DRS. WOOD AND WRIGHT, BUT THE TEXT HAS BEEN MOVED TO AN EARLIER LOCATION IN THIS DOCUMENT BY DR. WOOD IN HIS CURRENT UPDATED FEEDBACK.

Formatted: Indent: Left: 0.18 cm, Hanging: 1.25 cm

SO THE NIST GROUP CAME UP WITH THIS....

Dr. John Meldrum's (PEDIATRIC ABUSE EXPERT)version of a bite mark.....

A circular or oval curvilinear pattern or patterned injury consisting of either one arch or two opposed arches often, but not always separated at their bases by unmarked spaces.

Individual marks, abrasions, contusions, or lacerations may be found near the periphery of each arch. The marks present reflect the size, shape, arrangement and distribution of the contacting surfaces of the human teeth that made the pattern.

Either the maxillary or mandibular arch, or both arches, can be identified and the midline of each arch visible may be determinable.

Some of the marks made by the individual teeth can be recognized and identified based on their class characteristics and/or location relative to other features.

The size and shape of each visible arch is consistent with the size and shape of the human dentition.

Dr. Wood – Committee is not aware of a Dr. Meldrum that is involved in bitemark evidence evaluation. If you may be referring to Dr. John Melville, Committee is aware of Dr. Melville. However, it is very important for you to know and understand that this text above is not Dr. Melville's version of a bitemark definition. Dr. Melville requested a suitable definition be supplied to him to enable his understanding of bitemarks. The definition in the wording above was supplied to Dr. Melville by odontologist members of the Odontology Sub-Committee of the Crime Scene/Death Investigation Committee of OSAC.

Alissa (I think I.P.. but maybe NY State's attorney's office) suggested combining points 1 and 5.

Committee wishes to state unequivocally that it does not support the premise that it is advisable or acceptable to adopt a definition of bitemarks that has been drafted by someone that is not a dentist. This is notwithstanding that Committee understands this person was simply modifying the work of others.

A circular or oval curvilinear pattern or patterned injury consisting of either one arch or two opposed arches often, but not always separated at their bases by unmarked spaces. The size and shape of each visible arch is consistent with the size and shape of the human dentition.

Individual marks, abrasions, contusions, or lacerations may be found near the periphery of each arch. The marks present reflect the size, shape, arrangement and distribution of the contacting surfaces of the human teeth that made the pattern.

Either the maxillary or mandibular arch, or both arches, can be identified and the midline of each arch visible may be determinable.

Some of the marks made by the individual teeth can be recognized and identified based on their class characteristics and/or location relative to other features.

The size and shape of each visible arch is consistent with the size and shape of the human dentition.

A different order of the 5 points without combining 1+ 5 (just re-ordering)

A circular or oval curvilinear pattern or patterned injury consisting of either one arch or two opposed arches often, but not always separated at their bases by unmarked spaces.

The size and shape of each of these visible arch(es) is consistent with the size and shape of the human dentition.

Individual marks, abrasions, contusions, or lacerations may be found near the periphery of each arch. The marks present reflect the size, shape, arrangement and distribution of the contacting surfaces of the human teeth that made the pattern.

Either the maxillary or mandibular arch, or both arches, can be identified and the midline of each arch visible may be determinable.

Some of the marks made by the individual teeth can be recognized and identified based on their class characteristics and/or location relative to other features.

Committee used this list partly and will suggest an amendment with revisions to the Description of Bitemarks section at 2.b. i. accordingly.

iv. Evidentiary value of human bitemarks

1) General considerations:

- a) After a pattern or patterned injury has been determined to be a human bitemark, odontologists should evaluate the information in the bitemark for forensic significance or evidentiary value. The quantity and quality of the information (e.g. evidentiary value) should be determined to be sufficient before initiating comparisons to dentitions (see iv.2). Exactly what must be present to make a determination of "sufficient"? Without a restrictive definition of what exactly must be present in a pattern or patterned injury to definitively label it a BM, sufficient = best guess- pick and choose from the descriptors in the d 2 ii list and hope one is right. The ABFO diplomates who participated in the Freeman-Pretty-Senn study proved this and now this "evolution" document is ignoring one of the catastrophic failures in calling a pattern or patterned injury a bitemark identified by the study
- b) Induced distortion of the skin from biting action and other factors related to the nature of human skin can affect the recording of the dental features, arch size, and arch shape in the bitemark.

2) Conditions and features of bitemark evidence that indicate sufficient evidentiary value for comparisons to dentitions include but are not limited to:

- a) The bitemark pattern was properly photographed both without and with a reference scale a) in place, and b) on the same plane as the pattern or injury. Does this mean a high quality BM imaged only with a scale and lacking the identical exposure without a scale cannot be used? This is more about evidence collection than evidentiary value. The pattern determines the evidentiary value and the evidence collection from a technique standpoint either properly memorializes the evidence or not.
- b) Images used for comparison are properly focused, adequately illuminated, suitably exposed, and made with the plane of the image receptor either a) parallel to the plane of the portion of the bitemark being imaged, or b) not parallel to the portion of the bitemark being imaged but the images can be corrected for

Commented [RW21]: It is incumbent on the ABFO to specify precisely what must be present in a dermal bite mark that makes it have requisite evidentiary value.

the angle known as theta (θ) using image-management software. Not all images can be corrected for theta so this statement is not true.

Commented [RW22]: Correcting for theta is the devil's work. I would be VERY CAREFUL proposing this.

(see Theta (θ) in Appendix 1)

c) Either the maxillary or mandibular arch or both arches can be located and the midline of one or both arches can be determined.

d) Some discrete marks caused by individual teeth can be seen and recognized based on their class characteristics and/or location relative to other features. So, if some marks look like rectangles supposedly from teeth and adjacent marks are not identifiable as being caused by teeth, do the "discreet marks of the individual teeth trump the other marks?"

Formatted: List Paragraph, Justified, Indent: Hanging: 1 cm, Right: 0.21 cm, Space Before: 0 pt, Line spacing: Multiple 1.05 li, Numbered + Level: 5 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 3.76 cm + Indent at: 5.01 cm, Tab stops: 5.01 cm, Left

Commented [RW23]: This is pretty much the definition of cognitive bias and half a dozen other biases.

Deleted:

Formatted: Character scale: 100%

Formatted: Font: 10.5 pt

Formatted: Normal, Left, No bullets or numbering

Deleted: <#>See Michael West and Allan Warnick because they surely did this more than once.¶

Formatted: List Paragraph, Justified, Indent: Hanging: 1 cm, Right: 0.21 cm, Space Before: 0 pt, Line spacing: Multiple 1.05 li, Numbered + Level: 5 + Numbering Style: a, b, c, ... + Start at: 1 + Alignment: Left + Aligned at: 3.76 cm + Indent at: 5.01 cm, Tab stops: 5.01 cm, Left

Commented [RW24]: Insert the range of measurements

Commented [RW25]: Terrific – we say that these may affect evidentiary value but we don't say how???

e) The size and shape of each arch conforms to the variations of the size and shape of the human dentition.

3) Factors influencing the evidentiary value of bitemarks on humanskin:

a) Human skin factors. These factors appear to be more relevant to the assessment of determining if a pattern or patterned injury is a bitemark. The evidentiary value is for the most part determined be the overall appearance of the pattern. Since we cannot measure viscoelasticity or anisotropy or hysteresis -short term or long term, how can these be critical factors in the value of a bitemark?. They are important in explaining how the injury was created but provide little regarding evidentiary value

- i) Type
- ii) Thickness
- iii) Pigmentation
- iv) Nature of underlying tissues
- v) Viscoelasticity – cannot be measured
- vi) Anisotropy (orientation to skin tension lines) is anyone aware that there are MULTIPLE systems of classifying skin tensions lines ? see: F. Borges, Albert. (1984). Relaxed Skin Tension Lines (RSTL) versus Other Skin Lines. Plastic and reconstructive surgery. 73. 144-50. 10.1097/00006534-198401000-00036. This citation discusses SEVEN.
- vii) Hysteresis (short term only)
- viii) Vital response to injury this also cannot be recreated in an individual.

b) Injury factors

- i) Contusion
- ii) Abrasion
- iii) Laceration
- iv) Incision

- v) Avulsion
- c) Biting dynamics factors Again, these are factors in the creation of the pattern or injury pattern but not relevant in the value. i.e. does a minimal bite leaving few indistinct patterns have less value than an avulsive bite with obliterated wound borders.
 - i) Movement during biting by person biting or person bitten
 - ii) Force of the bite
 - iii) Positional changes during and after biting
- d) Age of the person bitten
 - i) The properties of human skin can change with age
 - ii) The skin of older persons can respond to trauma with different **levels?** (varying degrees) of contusion, abrasion, laceration, and other effects
 - iii) The skin of older persons can heal differently compared to the skin of younger persons

Commented [RW26]: We can never know these – and too often we opine on relative position of the biter to the bitten and do everyone a disservice.

Formatted: Font: Bold, Font color: Text 1

Committee suggests an amendment to change the phrase “different levels” to “varying degrees”.

- e) Health of the person bitten
 - i) Systemic diseases can affect the response of skin to trauma
 - ii) The effects or side effects of medications can affect the response of human skin to trauma [and how the bite mark may manifest.](#)
- f) Other
 - i) Healing process changes in bitemarks on living subjects
Examples:
 - (1) Edema presence,, progression, and resolution
 - (2) Contusion presence, progression, and resolution
 - (3) Scab formation and resolution
 - (4) Scars, fibrosis, and permanent skin changes
 - ii) [Postmortem changes in bitemarks on deceased subjects](#)
 - iii) [there is no mention of postmortem bites nor perimortem bites and the differentiation between their appearances grossly and/or microscopically.](#)

3. Linkage Terminology [This is redundant from the terminology section](#)

The ABFO standards and guidelines indicate that if sufficient information is available to support conclusions, bitemark linkage conclusions should only a) exclude or b) not exclude (*include*) a dentition. The specific terms found in 2.c. are a) for exclusion, [Excluded as Having Made the Bitemark](#), and b) for inclusion, [Not Excluded as Having Made the Bitemark](#). Stronger terms of attribution are not condoned by the ABFO (see Standard 1.f.)

4. References

- a. The link below directs readers to a list of bitemark evidence literature. The list was prepared in response to NIST-sponsored Research, Development, Testing & Evaluation Interagency Working Group questions. This statement was included with the list:

The ABFO wishes to emphasize that the research models utilized to date in most studies mimic human bitemarks only in cadaver skin or in skin of anesthetized animals, no research links these models (and their findings) to human bitemarks in living human skin.
ABFO Executive Committee, October 1, 2011.

<https://www.nist.gov/sites/default/files/documents/forensics/Annotated-Bibliography-Odontology.pdf>

- b. Following is a list of textbooks that include information on bitemark evidence arranged chronologically:
 1. Senn, D.R., Weems, R.A. (2013). *Manual of Forensic Odontology, 5th Ed.*

Commented [RW27]: Which requires a definition of whether the bite marking possesses enough detail to even warrant entering the comparison process.

Commented [RW28]: Linkage is the incorrect word. The fact that we use the word linkage at all is prejudicial
Definition of linkage
1 :the manner or style of being united: such as
a :the manner in which atoms or radicals are [linked](#) in a molecule
b :[bond](#) 3c
You most probably should be using "attribution" – attributing process.

Formatted: Not Strikethrough, Double strikethrough

Commented [RW29]: dump all references to the word inclusion, included etceteras.

Commented [RW30]: Just in case anyone is keeping track – referencing the ABFO board of directors as a reference and implying it carries ANY scientific weight is not appropriate. The BOD are lovely people but they are not in any position to judge research that has been already accepted in peer reviewed journals. Neither of these bodies of work require a SECOND peer review.

Commented [RW31]: Textbooks are generally the WORST source of scientific information since the authors (with full apologies to the authors of these learned texts) allow, and in fact require the author or editor to make numerous value judgments. See Moon library "Peer review" usually refers to the process scholarly journal articles go through before being published. Through this review process, experts on the article's topic verify the credibility of the information contained in the article. Textbooks can be good sources of general information, but would not be considered peer reviewed sources. And the range of these textbooks mean they are between 6 and sixteen years out of date (1 year before publishing).

Boca Raton, FL: CRC Press, Taylor & Francis.

2. Dorion, R.B.J. (2011). *Bitemark Evidence: A Color Atlas and Text. 2nd Ed.* Boca Raton, FL: CRC Press.

3. Herschaft, E.E., Alder, M.E., Ord, D.K., Rawson, R.D., Smith, E.S. (2011). *Manual of Forensic Odontology, 4th Ed.* Austin, TX: American Society of Forensic Odontology.
4. Senn, D.R., Stimson, P.G. (2010). *Forensic Dentistry, 2nd Ed.* Boca Raton, FL: CRC Press.
5. Silver, W. E., Souvion, R.R. (2009). *Dental Autopsy.* Boca Raton, FL: CRC Press.
6. Dorion, R.B.J. (2004). *Bitemark Evidence.* New York, NY: MarcelDekker.

The following guidelines sections comprise the Best Practices for evidence collection, analysis, comparison and reports. Best Practices should be followed by odontologists whenever possible and practical.

5. Evidence Collection

From Questioned Patterns, Patterned Injuries, Bitemarks, Persons of Interest, and Dentitions Why now are patterns called questioned patterns?

a. General considerations

- i. A questioned bitemark is a pattern or patterned injury that may or may not be a bitemark.
- ii. A dentition or subject dentition refers to the teeth of a known person of interest that may or may not have caused a bitemark. Is a foil a known person of interest?
- iii. The odontologist who collects the evidence from a questioned pattern, patterned injury, or bitemark ~~shall should~~ not also collect evidence from the dentitions of known persons of interest (see 2.a.iii.1).
Formatted: Strikethrough
- iv. If only one person of interest is proffered, then a line-up of dentition evidence from persons of interest and foils should be employed. (see Foil in Appendix 1) Foils should be persons unrelated to the case but with similar dentitions. (see 2.a.iii.2). This appears to be in conflict with item ii above as the BM investigator doesn't know there are foils in the fold which means all dentitions represent persons of interest.
- v. An odontologist performing comparisons should be blinded to the identities of persons of interest and their dentitions (see 2.a.iii.4). And foils.
- vi. Evaluation of bitemark evidence includes:
 - 1) Examination of questioned patterns and patterned injuries to form conclusions, if the evidence allows, of whether or not they are bitemarks. There is still no list of what absolutely must be present in a pattern or patterned injury to unequivocally label it a bitemark. Thus, this is essentially the same as the current 1976 definition still in the DRM
 - 2) Interpretation and analysis of those questioned patterns or patterned injuries that are concluded to be bitemarks again by what definitive criteria is the determination made and supportable?
 - 3) Comparison of evidence from bitemarks containing sufficient evidentiary value to evidence from subject and foil dentitions, and how much has to be present in the pattern so it contains sufficient evidentiary value? One or two the list of what CAN appear in a bitemark from back in the earlier section? Using only one or two items for that list, almost any circular or semi-circular pattern can have

sufficient evidentiary value the way it's written

- 4) Formation of opinions, if the evidence allows, of whether a bitemark is excluded or not excluded as being caused by the subject and foil dentitions How exactly does one determine if the evidence allows? How does it disallow? This is redundant on my part but without a restrictive definition of what must be present in a pattern or patterned injury to definitively label the pattern a BM, which was done in the draft rejected last year, this begs for interpretations that will ultimately put innocent people in jail

- i. Following evidence-based evaluation and analysis and if the evidence is sufficient, comparisons of bitemarks to subject and foil dentitions can be undertaken. These steps should follow established guidelines. Together they constitute a forensic physical comparison. Please show me in this document the established guidelines (produced by ? and validated by? With an established error rate of? This is utter nonsense. I went to Appendix 1 to look up the definitions of "forensic physical comparison" and "established guidelines" but nothing was there.

Formatted: List Paragraph, Justified, Right: 0.21 cm, Numbered + Level: 3 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 2.68 cm + Indent at: 3.68 cm, Tab stops: 3.68 cm, Left

Deleted: ¶

Formatted: Font: 10.5 pt

vii. Because bitemark evidence evaluations, analyses, and comparisons fall within the knowledge spectrum described in state and federal rules of evidence as “scientific, technical, or other specialized knowledge that can be helpful to the court,” the admissibility of bitemark evidence in a legal proceeding is a determination made solely by the court. Why is this even included? It sounds like the writers are begging the reader to believe BMs are useful because the courts have so far said so. It has nothing to do with handling bitemark evidence

Commented [RW32]: It also fails to point out that neither the gatekeepers or the juries are in any way equipped to judge any of these factors.

b. Case information

- i. Case agency, case number, and date of examination should be noted and can also appear on the reference scale utilized for photographs.
- ii. The names of subjects should be recorded, if available, as well as the place of examination. However, information produced for blinded second opinions or independent verifications of conclusions should omit names or other identifying information If the lead investigator isn't provided the names of the subjects does the investigation stop? The term "if available" is unnecessary if not prohibitive
- iii. The medical or legal authority that requested or provided authorization for the odontology examination should be documented.

c. Chain of custody

- i. Receipt of any evidence by the odontologist should be clearly documented using appropriate chain of custody documentation, including the case name and number, time and date of delivery, an inventory of the evidence delivered, and from whom the evidence was received, along with the recipient's signature.
- ii. Release of evidence by the odontologist should be similarly documented.
- iii. A copy of the chain of custody documentation should be retained as part of the case record.
- iv. The odontologist should place his/her mark and date of examination on each item of physical evidence, such as dental casts, CDs, DVDs, photographs, etc. in a non-diagnostic area using a method that does not materially alter the item or evidence but is a permanent identifiable marking showing the odontologist had possession of or viewed that piece of evidence.

Commented [RW33]: I would think that if you marked a piece of evidence it would be difficult for the next observer to remain unbiased.

Deleted: .

d. Evidence collection from questioned bitemarks

- i. General considerations
 - 1) In the context of this section the terms questioned bitemark, pattern, and patterned injury can be used interchangeably.

- 2) Initial evidence collection from a questioned bitemark can be a one-time event without the possibility of a follow-up examination. When the odontologist is involved in the initial examination, collection of evidence from the site(s) should include the methods of documentation described below.

3) Evidence that was collected by others may be provided. Odontologists should assess such evidence and proceed only if the forensic significance or evidentiary value of the evidence justifies continuing the analysis. This section is supposed to describe the evidence collection which has nothing to do with analysis. That comes later. Ibid on the forensic significance – justifies continuing part.

Commented [RW34]: Doesn't this mean that there should be some definition of "evidentiary quality."

4) Legal permission in the form of a written consent, search warrant, subpoena, or court order should be obtained from the appropriate authority prior to investigative procedures and should be noted in the reports.

ii. Documentation

1) General descriptors

- a) Case agency
- b) Case number
- c) Examiner
- d) Age, sex, and race of bitemark recipient

2) Pattern location

- a) Anatomical location of patterned injuries
- b) Surface contour
- c) Tissue characteristics
- d) Object (medium) description, if not human skin

3) Pattern or injury features

- a) Size
- b) Shape
- c) Nature (abrasion, contusion, laceration, avulsion)
- d) Other (indentations, incisions, unusual features)

4) Pattern description

- a) Orientation of maxillary/mandibular dental arches
- b) Locations of midlines
- c) Individual tooth marks
- d) Unmarked areas
- e) Tooth rotations, translations or anomalies
- f) ~~Summary Summary? Just for this section? This doesn't need to be included~~

Formatted: Strikethrough

iii. Orientation photographs

Prior to other evidence collection procedures, orientation images should be exposed to document the identity of the object or person, case information, and clearly demonstrate the location(s) of the questioned bitemarks.

iv. Swabbing

If not already accomplished, each questioned bitemark should be swabbed for biological evidence following the proper protocols for the jurisdiction. [And what if that jurisdiction doesn't normally swab?](#)

v. Photography

- 1) Under normal circumstances the pattern or patterned injury should be photographed using a high quality digital camera. [Whenever possible the photographic procedures should be performed by or under the direction of the forensic odontologist.](#)
- 2) Once the orientation images have been exposed as recommended in 5.d.iii. progressively closer photographs should be sequentially exposed of each questioned bitemark.
- 3) Images should be of sufficient resolution to allow for enlargement to life-sized dimension without [pixilation.](#)
- 4) Photographs of the pattern or patterned injury should be exposed both without and with a properly placed and labeled [with a scale, preferably an ABFO No.2^o reference scale. If there is no ABFO scale, don't take the images?](#)
- 5) In some cases it can be beneficial to obtain serial photographs of the patterned injury over time. [Without actually taking the images over time, how does one know when the case falls into the "in some cases..." category?](#)
- 6) Both ambient and artificial lighting can be used, as well as infrared (IR), reflective ultraviolet (UVA), and alternate light source (ALS) imaging when indicated. [Since these techniques create images not seen with the unaided human eye, how does an investigator know which case fits "when indicated"? If the equipment is available, they should always be taken. The investigator has no way of knowing what will appear in these types of images so it ridiculous to use a term "when indicated".](#)
- 7) Video imaging can be used *in addition* to conventional still photography.

Commented [RW35]: What constitutes a high-quality camera?

Commented [RW36]: By definition pixilation is present in all digital images and additionally the rate-limiting step on naked eye appreciation of an image is almost always the monitor – not the camera.

Commented [RW37]: I concur.

vi. Impressions

- 1) Impressions should be taken of the surface containing questioned bitemarks, especially when three-dimensional properties are present. The impression materials used should meet American Dental Association (ADA) specifications and should be documented by name, including lot number and expiration date, in the report. [No forensic odontologist I know takes impressions of bitemarks that lack distinctive 3D properties.](#)
- 2) Impressions should be taken of the dentition of a person with a questioned bitemark to assess the possibility of a self-inflicted bitemark. Or, in case the person with the questioned bitemark may have bitten another person that was involved in the incident. [This](#)

Commented [RW38]: I am unaware of this ever being of any consequence at any point in bite mark cases.

sections is titled Bitemark Evidence Collection. What does the last sentence dealing with a biter have to do with bitemark evidence collection. That statement should be in the biter evidence collection section

- a) Adequate support should be provided for the impression material.
- b) Impressions should be poured with appropriate ADA listed materials following the manufacturer's directions. The resulting casts should be labeled and stored following appropriate chain of custody.

vii. Checklist – A checklist for Evidence Collection from Questioned Bitemarks is at Appendix 3

e. Evidence collection from persons of interest

i. General Considerations

- 1) Subject dentitions are the teeth of persons of interest.
- 2) Prior to collecting evidence from persons of interest, the odontologist should ensure that a written search warrant, court order, or other legal consent has been obtained from the appropriate authority, or the subject person in the case of informed consent.
- 3) Court documents or consent as in 2) above provide legal authority for the collection of the evidence listed below. Copies of these documents should be retained as part of the case record. This is redundant in both statements and should be deleted. Case documentation already stated to keep copies of the search warrants etc and item 2 above already says to get the appropriate document
- 4) ~~Whenever practical,~~ the odontologist who collects the evidence from a questioned bitemark ~~should~~ shall not also collect evidence from the dentitions of persons of interest. An exception exists if, in the judgment of the odontologist, a questioned bitemark could have been self-inflicted. In these cases, the odontologist should also collect evidence from that person's dentition. redundant
- 5) Similarly, whenever practical, a second odontologist or another dentist should collect evidence from persons of interest following the guidelines below. I see no labeling of any section called "guidelines" below.
- 6) If only one person of interest is proffered, in order to produce a dental line-up a second odontologist or dentist should collect or provide evidence from other individuals who are foils with similar dentitions to the person of interest. Redundant

Formatted: Strikethrough

Formatted: Strikethrough

Commented [RW39]: I think line-ups and line-up size (number of people) are useless as per the Bush studies.

ii. Evidence collected should include:

- 1) Demographic and other identifying information such as race, height, weight, age and tattoos on the calf or buttock? Why is this necessary
- 2) Dental treatment records, if available.

iii. Photography

To the extent possible, photographic documentation should include:

- 1) Extraoral photographs
- 2) Full face
- 3) Right and left three-quarter profiles What constitutes ¾ profile exactly? Why is this necessary? Does anyone actually do this as a requirement

- |
- 4) now? Right and left full profiles
- 5) Intraoral photographs (with retractors and mirrors as needed):
- a) Anterior view in centric occlusion
 - b) Anterior view with anterior incisal edges slightly opened

Commented [RW40]: How about with teeth closed in the normal position and again with the teeth parted. There is no valid scientific data to suggest that say, a perpetrator, when biting someone in the act of assaulting or killing them is doing so while simultaneously keeping an eye-out to make sure that their mandibular condyles are placed "just-so" in their articular fossae.

- c) Anterior view with mandible protruded
- d) Anterior view demonstrating maximal opening
 - i) with reference scale
 - ii) without reference scale
- e) Lateral views, both left and right sides
- f) Occlusal views of each arch
- g) Additional photographs that may provide useful information
- h) Images of surfaces of test bites with and without reference scales

6) Video imaging can be used *in addition to* conventional still photography

iv. Intraoral examination

The dentist performing the intraoral examination should document the condition of the teeth, including the following:

- 1) Missing teeth
- 2) Fractured teeth
- 3) Mobile teeth
- 4) Condition of the periodontium
- 5) Maxillary and mandibular tori
- 6) Tongue and lip piercings and/or jewelry
- 7) Other unusual intraoral features or anomalies

v. Impressions

- 1) Maxillary and mandibular impressions should be taken. Both conventional and digital impression techniques utilized in clinical dentistry are acceptable.
- 2) For conventional impressions, ADA-listed materials should be used following established dental impression techniques. Dental casts should be produced from impressions following established techniques.
- 3) For digital impressions ADA-listed optical scanner and laser scanner techniques are acceptable.
 - a) The digital files from the scans can be used for digital analyses utilizing fit for purpose software techniques. I doubt that only a mere .001% of the population has any idea what this means.
 - b) Alternately, the digital files can be used following established techniques to produce physical dental ~~casts~~ models.
- 4) If removable prostheses are present, impressions should be made both with and without the prosthetic appliances *in situ*.
- 5) The inter-occlusal relationship should be recorded using ADA-listed materials and techniques.

Formatted: Strikethrough

vi. Sample or test bites should be recorded using ADA-listed materials and appropriate techniques. These items should be labeled, photographed, and retained. Neither this document nor the ADA list any appropriate techniques for making test bites. However, this document should describe such techniques but doesn't

vii. Dental casts

- 1) If physical casts from either conventional or digital impressions are produced, master casts should be prepared. For master casts produced from conventional impressions, ADA-listed Type III dental stone prepared according to manufacturer's instructions should be used following established dental techniques. Master casts may also be made from digital files from digital 3D scans using fit for purpose ADA-listed materials.
- 2) Additional casts can be poured from polyvinylsiloxane or polyether impressions or fabricated from digital files. Each subsequent model poured should be sequentially labeled to indicate the order of production.
- 3) If the original conventional impressions are taken using alginate or similar materials, duplicate casts can be produced from an impression of the master cast made using ADA-listed materials for duplication.
- 4) Duplicate casts should be appropriately labeled and the master cast utilized to produce the duplicate should be noted.
- 5) Master casts should not be altered. All tests and experiments should be performed using duplicate casts. Digital models have no such restrictions as they are all nearly identical

viii. Other evidence

Upon request, additional reference samples can be collected and stored with appropriate authorization and following established protocols.

f. A checklist for dentition evidence collection is at Appendix 4

The preceding section is VERY prescriptive and very "nailed-down" - which is fine however why are we not equally prescriptive in the section of "what a bite mark is" and "what is the evidentiary value of the bite mark." I would venture to say if we made the casts in plaster, type II stone, Type III stone would make far less difference to the process than if we nail the definitions of "bite mark" and "evidentiary value" down with equal precisions.

6. Bitemark Analysis

a. General considerations

- i. Bitemark analysis in the context of this section refers to the analysis of patterns or patterned injuries that may or may not be bitemarks, as well as the continued analysis of patterns or patterned injuries that in the opinion of the odontologist are bitemarks.

Commented [RW41]: We have no business straying into the territory of pattern injuries – that is the domain of the forensic pathologist.

- ii. Once an odontologist forms an opinion that a pattern is a human bitemark, the odontologist should complete the analyses of that bitemark before making any comparisons to the dentitions of persons of interest.
- iii. Comprehension of dental and oro-facial anatomy and morphology, plus an understanding of dental treatment modalities, are required for evaluation and interpretation of a pattern or patterned injury caused by human teeth.

Does this mean the odontologist needs to know , for example, implant placement and restoration techniques to determine if an anterior tooth (implant retained crown) that may have marked in a pattern is required? Isn't a dentist already supposed to know all of this by virtue of education and professional experience? I fail to see why this is relevant and needs to be included. If an odontologist doesn't practice with live patients, then a deficiency in the odontologist's qualifications will be discovered.

b. Interpretation of a Pattern or Patterned Injury as a Bitemark there is no restrictive concise definition of what characteristics, patterns etc MUST be present to define a pattern or patterned injury as a bitemark. Such a definition sets a foundational boundary which must be met or exceeded for a pattern or patterned injury to rise to being called a bitemark. This document is so loosely structured and scattered regarding what features may be present, how they may look, how big or small they can be etc that an odontologist has the ability to pick and choose what he/she wishes to include leaving virtually unlimited numbers of possible patterns open to being called bitemarks. This is a fatal flaw in this document.

Commented [RW42]: And I reiterate we are so precise with respect to what we know (materials, scales, lighting) and yet we get really cloudy on bite mark features.

i. Assessment of a pattern

1) Determining the orientation of the marks caused by maxillary and/or mandibular teeth. The relative size and morphological differences visible in the pattern may support differentiation between marks from the maxillary and mandibular arches. Assessments may include, but are not limited to:

- a) Locating within the marks the position(s) of the midline(s) of the maxillary and/or mandibular arches. Midline(s) of the maxillary and mandibular arches may be determined either by noting the central incisors visible in the mark, or by determining the midpoint of each arch. How is this done if the central incisors are missing, or even more, if all the incisors are missing? Does this mean the incisors must be present? How is a midpoint in an arch established in the absence of incisors?
- b) Locating marks caused by specific teeth by examining the anatomical morphology of the incisal edge patterns. So if an upper canine and lateral incisor are transposed (of which there are several in my practice) the marks created by those teeth will not conform. Do premolars have incisal edges?
- c) Locating areas without marks potentially due to missing, fractured, unerupted, not fully erupted, malformed, or ectopic teeth. Ectopic teeth don't leave marks?
- d) Locating features that indicate rotations, translations, or other anomalies caused by specific teeth.
- e) Performing a manual or computer-assisted metric analysis of the overall and specific features of the questioned bitemark. Skin deforms when bitten in unknown directions and amounts. Creating these measurements may provide some best guess number that will accurate to what degree and error rate? Measuring the borders of a pattern (such as intra-canine width) may be useful in helping determine size but measuring individual marks in relation to a suspect dentition can be dangerous. We actually know so little in this area that trying to use information from measurements of patterns, especially individual marks, in skin as a recommendation is going to get slaughtered in the legal system. The truth is we are guessing relevance.

Commented [RW43]: I concur completely – there are a lot of skin and organism bitten variables that we may not be able to account for.

- f) Locating drag marks (e.g. abrasions, striations) in relation to specific teeth induced by motion during the act of biting.
- 2) Summarize the features that form the pattern including:
- a) Class characteristics of:
 - i) Primary dentition
 - ii) Mixed dentition
 - iii) Permanent dentition-
neither here nor in the appendices is there a summary that lists exactly what features must be present to differentiate between these dentitions. Research in this area has not been supported by the writers of this document. Again, this is best guess.
 - b) Individual characteristics
 - i) Individual arch characteristics
 - ii) Individual dental characteristics
 - c) Anomalies or other unusual features
- 3) Form conclusion
- ii. Graphic aids

Commented [RW44]: I would have a tough time differentiating a mixed dentition patient from a permanent dentition with a few missing back teeth. I have also been burned on pediatric v. adult more than once.

Odontologists can use graphic aids to assist in the analyses or to demonstrate features of a questioned bite mark. For example, a software program can be used to optimize an image or to create demonstrative graphics.

c. Conclusions and Opinions

Following completion of the bite mark analyses, conclusions should be made following ABFO terminology guidelines (see 2.b and 2.c). A list of features that support the conclusion(s) should be included.

7. Bite mark Comparisons

a. General considerations What is missing here is any mention of suspect dentitions in a given case (NOT foils) that are of similar size, arrangement and position regarding their individual dentitions. Suspect biters each of whom have nearly identical intra-canine widths and perfectly finished orthodontically aligned teeth cannot be used in a comparison. It would be impossible to differentiate between those dentitions even in what could be identified as the "perfect" bite mark. This too is a fatal flaw in this document.

- i. An unknown exhibit (i.e. questioned bite mark), for which the odontologist is attempting to identify the origin, should be compared to the known reference exhibit(s) (i.e. dentition evidence).
- ii. Only patterns and patterned injuries that the odontologist has concluded are human bite marks should be compared to the dentitions of persons of interest.
- iii. Patterns and patterned injuries the odontologist has concluded are animal bites can be compared to the dentitions of animals of interest.
- iv. Bite mark analyses should be completed before comparisons to dentitions are undertaken.
- v. To the greatest extent possible, odontologists should be blinded to information about the dentition evidence that would disclose the identity of a person of interest.
- vi. Whenever possible, a second odontologist or other dentist should collect the dentition evidence from persons of interest and from foils and then provide that evidence in a manner that allows odontologists performing comparisons to be blinded to the source.
- vii. Bite mark comparison conclusions are odontologists' opinions derived from evaluations and analyses based on education, training, knowledge, skill, and experience. Since Daubert, "training, knowledge, skill and experience" have been replaced by "scientific proof". It's actually shocking to read. An expert can go into court and claim they must be believed because they've got x years experience and therefore, they know exactly what they're doing. This is so regressive I can't believe it's actually written here. This is exactly what NIST and the rest of the forensic scientific world is trying to get away from.

Commented [RW45]: I would venture to say this almost never happens in real life – I would say it is more likely that an examiner seizes on one or two markings and then "runs with those" to the end zone.

[Again read the report of the Texas Forensic Science Commission-they profoundly disagree.](#)

b. Methods of comparison

i. Overlays

- 1) Overlays are tools useful for comparing a dentition to a pattern or patterned injury determined to be a bitemark. Overlays can be hollow volume, solid volume, semi-transparent, or other representations of the biting surfaces of subject or foil dentitions.

Commented [RW46]: Should probably note here that one can use Photoshop to introduce similar (not the same) errors in overlay as one can find in hand traces – or minimally we cannot prove that it is not susceptible to bias.

- 2) Overlays can be computer generated from 2D or 3D scans of the subject or foil dentitions, 2D photographic images of the teeth or dental casts or 2D or 3D scans of dental casts.
 - 3) Odontologists should confirm that the overlays and the images to which they will be compared are identically sized.
- ii. Test bites [A test bite needs a definition, for which I couldn't find one. Can "text bites" be collected from the suspect dentition owner when taking models and photographs? This list says only models....](#)
- 1) Test bites are made by producing simulated bites in a medium using dental casts. The medium used for the test bites can be dental wax or other ADA-listed dental materials, animal skin, human skin, or other media. Test bites can be made in more than one medium.
 - 2) Test bites can be used to produce overlays. The overlays can be manually or computer generated and compared to or superimposed over same-sized images of the bitemark.
 - 3) Test bites can be useful to analyze similarities or differences between the test bites and the bitemark. Analyses can be completed side-by-side or utilizing an overlay technique.
- iii. Additional comparison techniques may include, but are not limited to:
- 1) Exemplars of the subject's dentition compared to corresponding-sized images of the bite pattern
 - 2) Life-sized casts of subject's dentition compared to life-sized images or 3D casts of bitemark patterns
 - 3) Manual or computer-generated comparisons
 - 4) Digitization and computer enhancement of images [Item 4 and 5 are redundant](#)
 - 5) Use of computer software to enhance comparisons
 - 6) Stereomicroscopy
 - 7) Scanning Electron Microscopy
- c. Conclusions
- Conclusions should be expressed following ABFO Standards and Guidelines. A list of features supporting conclusions should be included.
- d. ABFO Bitemark Analysis and Comparison Algorithm [There are plenty of things I don't like about this flow chart, especially compared to the much simpler one from Dr. Wood and his team. I won't waste more of my time on this.](#)
- The algorithm is intended as a graphic aid to odontologists. See following page.

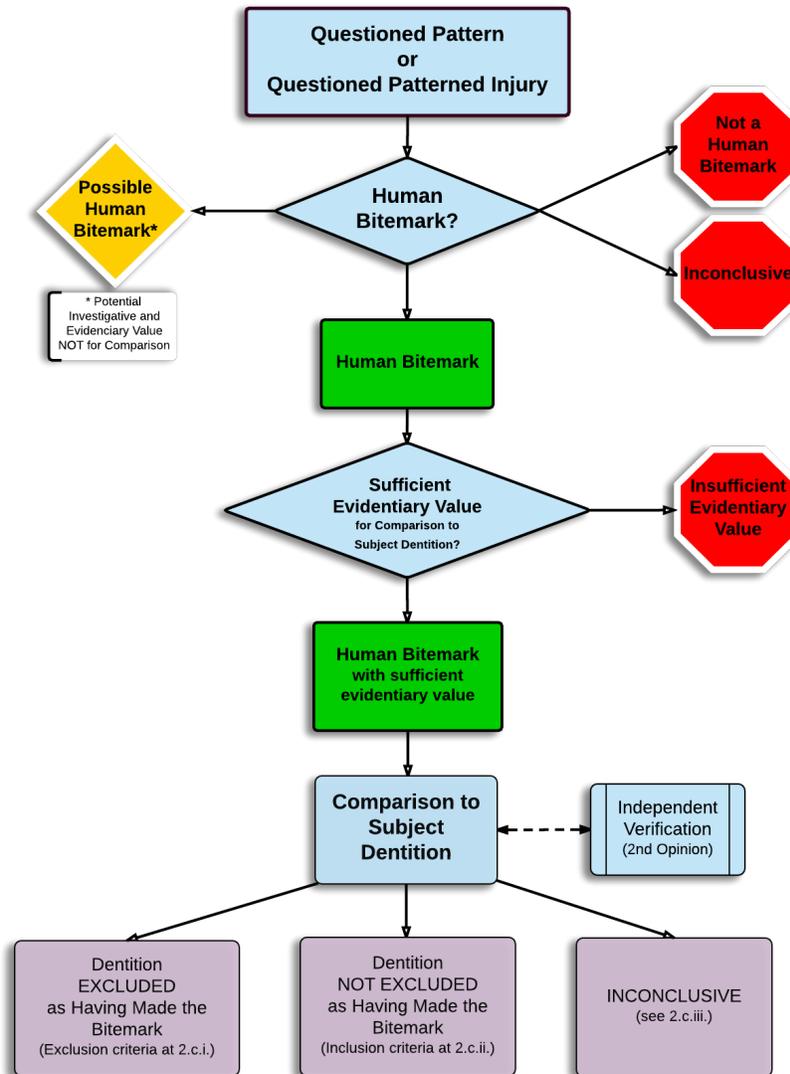
Commented [RW47]: Test bites should be discarded as a concept. If we don't want the primary examiner to know the identity of the models why should we let that same person loose on a series of poor defenseless Styrofoam cups? It is buncombe and would make cross-examination a barrel of monkeys (for the opponents lawyer.

Commented [RW48]: Pray tell, how does the excluded examiner/comparer make test bites with ANY dentition when he knows what the bite mark looks like (because he saw it!) – terrible cognitive bias.

Commented [RW49]: If I was a defense attorney I would LOVE to see the phrase "enhance comparison" – "So doctor you were kind of pooched right up until the time you "changed" the bite mark using your magic computer and then you "found" a match???"

Commented [RW50]: Laughable – skin is a useless impression material – why not, as good comedy principles tell us not go to the extreme and include the Hubbel space telescope?

ABFO Bitemark Analysis and Comparison Algorithm



Commented [RW51]: In the chart remove possible bitemark. We have no business saying anything about something that is, after all inconclusive. Merriam Webster defines possible as: Definition of possible

1 a :being within the limits of ability, capacity, or realization

- a possible but difficult task

b :being what may be conceived, be done, or occur according to nature, custom, or manners

- the best possible care
- the worst possible circumstance

2 a :being something that may or may not occur

- a possible surprise visit

b :being something that may or may not be true or actual

- possible explanation

3 :having an indicated potential

- a possible housing site

I rather think we are dealing with definition (2) as it is used here and Merriam also defines "inconclusive" as : Definition of inconclusive

:leading to no conclusion or definite result

- inconclusive evidence
- an inconclusive argument

I think after the Pretty Senn Freeman study it is more than reasonable AT THIS TIME to draw no conclusions about anything from "a possible" bitemark.

Another comment on the chart – you don't need both the blue diamond "Human Bitemark" and the green square "human bite mark"

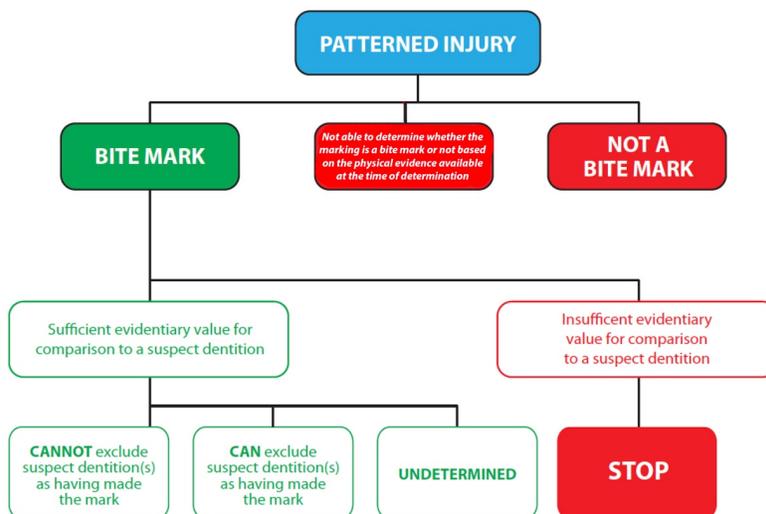
You don't need both the blue diamond "Sufficient evidentiary value" and the green square "sufficient evidentiary value". Their presence makes it appear like we have a learning disability and need to pause to take the same step twice.

ALWAYS AVOID ANYTHING THAT APPROACHES THE TERM "INCLUDED" – INCLUDED AND "NOT EXCLUDED" ARE, TO QUOTE TWAIN ON USING THE CORRECT WORD – "THE DIFFERENCE BETWEEN LIGHTNING AND LIGHTNING BUG."

THE INDEPENDENT VERIFICATION (2ND OPINION) SHOULD NOT JUST APPLY TO THE COMPARISON SECTION AND SHOULD BE REMOVED FROM THE CHART. BY LEAVING IT HERE YOU ARE TELLING THE SECOND REVIEWER THAT **THERE IS INDEED A BITE MARK** THAT INTRODUCES AN INORDINATE NUMBER OF BIASES. THEREFORE DROP IT. LET THE second opinion person REACH THEIR OWN CONCLUSIONS.

The following was developed by the NIST panel which included three ABFO odontologists, a British odontologist, a member of the real IP in New York, The New York State's prosecuting attorney's office and an expert in child abuse. I think it is far superior to the one above because it is simpler, uses non-prejudicial language and allows for an attribution conclusion of undetermined – which means it cannot be determined – not inconclusive.

NIST ADOPTED BITE MARK ALGORITHM



Bite Mark Evidence Reports

- e. General considerations
 - i. The guidelines below apply generally to preliminary, interim, and final reports. The suggestion here is that it's good to have lots of reports before the "final" report, all of which are discoverable and will be chum in the ocean

of opposing shark attorneys. There should only be one conclusive report based on the information and evidence available when working the case. This final report can be amended if necessary should more evidence or case information arise. I cannot think of anything worse report-wise than having to sit in testimony explaining all the things that were present, changed, modified ad infinitum when it can almost impossible to even get through a final report which stands alone. Giving the impression that all of these pre-final reports are acceptable and endorsed is going to create something beyond living hell on the stand for the odontologist.

Commented [RW52]: I concur. Enjoy three X as much cross-examination. How about you issue only a single report. At the end.

- ii. For preliminary and interim reports, the section on opinions of linkage between dentition(s) and bitemarks can be omitted. Why is this being sanctioned?

Commented [RW53]: If they are omitted then the defense is free to ask how you went through the process but later allowed one of the very many forms of bias to influence the final report.

f. Independent verification

- i. An odontologist investigating a human bitemark case ~~shall~~ ~~should~~ seek independent verification in the form of a second opinion from a minimum of one ABFO Diplomate before submitting a final report. (see 2.a.iv). See the Texas Forensic Science Commission report

Formatted: Strikethrough

- ii. A second opinion checklist is at Appendix 5

Commented [RW54]: I concur

g. Components of bitemark evidence reports may include:

- i. Introduction – Background information for the case. For example, what was requested, by whom, when requested, and why the request was made.
- ii. Inventory of evidence received – Evidence submitted to the odontologist, including how and when acquired.
- iii. Inventory of evidence collected – Type, source, and authority for evidence collected by the odontologist, evidence collected, official exhibit number assigned to the items of evidence collected, collection location, and date and time custody of each exhibit was accepted. And documentation of the chain of custody for each item that at any time came into the hands of the examiner and later was returned or transferred to someone else.
- iv. Findings regarding pattern – Opinion stated using ABFO terminology whether the pattern is a bitemark or not.
- v. Analysis – Methods employed, including the times and dates when the analyses took place.
- vi. Results – Outcomes of analyses and comparisons.
- vii. Conclusion – Conclusions and opinions of the relationship between each bitemark and dentition using ABFO terminology (see 2.b). Only one term of conclusion should be used for each comparison.
- viii. Disclaimer – Optional statements can be included to convey that the opinion(s) are based on the evidence examined. ~~For example, the odontologist can reserve the right to file subsequent reports should other~~

Commented [RW55]: Jeebus Cripes you forgot "possible bitemark."

Commented [RW56]: Who cares when the analyses took place. What earthly good does that do?

Formatted: Strikethrough

Commented [RW57]: "This report was completed with the materials available at the time the report was issued. The author of this report reserves the right to amend the report should further evidence become available." That's pretty much all you have to say.

evidence become available.

8. Appendices

Appendix 1 – Glossary of Terms

Appendix 2 – Uses of Bitemark Evidence

Appendix 3 – Checklist for Evidence Collection from Questioned Bitemarks

Appendix 4 – Checklist for Evidence Collection from Dentitions of Persons of Interest

Appendix 5 – Checklist for Second Opinions in Bitemark Evidence Cases

APPENDIX 1
Glossary of Terms Used in Standards and Guidelines

WHERE IS ANY MENTION OF BIAS? THE NAS report lists bias over 100 times as a complicating factor in all forensic science investigations Yet, this draft fails to even mention it. I did a word search and found exactly ZERO mentions of bias in the entire document. How is it possible to just ignore bias?

Bitemark (*bite mark* and *bite-mark* are also acceptable forms)

- A physical alteration with a representative pattern that is registered in a medium caused by the contact of the teeth of a human or animal

Class Characteristic

- A general characteristic that defines a category of items or objects but alone is insufficient to establish identity
- A feature, trait, or pattern that distinguishes the human dentition from other items or objects or the dentitions of animals
- A feature, trait, or pattern that distinguishes a bitemark from other patterned injuries

Dental Prosthesis

- An artificial replacement of one or more teeth and/or associated structures

Dentition

- The teeth in the dental arches

Excluded

- In relation to bitemark evidence, a subject or foil dentition that is eliminated as having caused a bitemark

Exemplar

- A demonstrative example or model of an item or object(s)
- In bitemark evidence comparisons, exemplars are used to demonstrate the shape, size and position of the biting surfaces of the dentition

Foil

- In the context of a dental line-up for bitemark evidence comparisons, an individual or evidence from an individual that is not a person of interest but rather a distractor

Guideline

- An item, action, or level of practice or conduct that is recommended or suggested but not mandatory

Individual Characteristic

- A characteristic caused by intentional, unintentional, or accidental changes during use, development, etc. that are exceptional and can be used to individualize or identify a specific item or object
- A feature, trait, or pattern that represents an individual variation rather than an expected finding within a defined class or group

Not Excluded

- In bitemark evidence comparisons, a dentition that cannot be eliminated from having

Commented [RW58]: We absolutely need a list of biases or potential biases with their definition and an illustrative example.

Formatted: Font: Not Bold

caused a bitemark

- The dentition is included in the population of dentitions that could have caused the bitemark
- Results of a comparison that determines the absence of unexplainable discrepancies

Objective

- Developing and maintaining neutral and unbiased attitudes, approaches, and opinions that are based on the available evidence

Pattern

- A distinctive shape, form or array
- In the context of bitemark evidence, a distinctive shape, form or array that appears in or on tissue or in or on a medium other than tissue

Patterned Injury

- An injury in tissue with distinctive shape, form or array indicating the characteristics of the contacting surfaces of the object(s) that caused the injury

Perimortem

- Occurring at or about the time of death

Person of interest

- An individual or subject who may or may not be associated with an event
- In the context of bitemark evidence, an individual or subject who had or may have had access to an individual who received a bitemark during a specified time interval

Shall

- The referenced item, action, or proscription is mandatory

Should

- The referenced item, action, or proscription is recommended

Standard

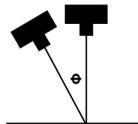
- A compulsory (i.e. mandatory) item, action, or level of practice or conduct

Subject Dentition

- The teeth of a person of interest that may or may not have caused a bitemark

Theta (θ)

- In the context of pattern or patterned injury evidence photography, when an image is recorded with the plane of the image receptor not parallel to the portion of the pattern being imaged, theta (θ) is the angle between an imaginary line perpendicular to the image receptor plane extended to a point on the surface imaged and an imaginary perpendicular line from an optimally placed camera's image receptor plane extended to that same point



APPENDIX 2 Uses of Bitemark Evidence

Bitemark evidence may be used to:

1. Document aspects of violence
2. Provide a profile of the dentition of a person of [- yep this isn't proven nor provable at this time.](#)
3. Compare information from bitemarks to subject or foil dentitions
4. Provide a potential physical and temporal link between a recipient of a pattern or patterned injury and the dentition of the perpetrator
5. Support or refute the history of events that is reported by individuals in a legal proceeding
6. Further potential uses (from Silver, W.E., Souviron, R.R. (2009). *Dental Autopsy*. Boca Rotan, FL: CRC Press.):
 - a. A bitemark can indicate the infliction of pain [\(or not\)](#)
 - b. Bitemarks can be offensive, defensive, or consensual
 - c. Bitemarks usually indicate acts of violence [\("usually" – I don't think this is proven.](#)
 - d. A bitemark can cause permanent injury; for example, avulsion of an ear, finger, nose or other body part
 - e. Bitemarks of high evidentiary value with distinctive markings can yield clues about the dentition of the questioned dentition – even in the absence of a formal comparison [– This is now the first step on the road straight to having your picture in the newspaper with the unfortunate Dr. West.](#)
 - f. Bitemarks in different stages of healing can indicate episodic infliction of injuries or abuse over time [– except we all know there is no 100% reliable way of measuring these times.](#)
 - g. Absence of any vital skin reaction (e.g. hemorrhage, swelling, etc.) can be indicative of a bitemark caused following death [– or not – we don't KNOW this and we can't ever do a human experiment.](#)
 - h. Relative positions of the participants in violence involving bitemarks can vary. The location and orientation of bitemarks can provide odontologists with clues to interpret the dynamic interchange [– nope – you can swivel your head pretty well and also people can move around. All you can really tell is whether something is a potential self-bite or not. See immediately below](#)
 - i. Anatomical locations of some bitemarks indicate that the bitemarks could not have been self-inflicted
 - j. Presence of a bitemark should prompt medical personnel or members of the death

Commented [RW59]: I thought this might be a good idea but now that I see it as an appendix I think it is a poor one. I think that this should be written in a preamble to the bite mark guidelines and not put in "list" form. I also think many of these items cannot be proven scientifically – for example a sexual bitemark may have been made in a moment of passion CONSENSUALLY but appear to be rather violent and perhaps painful. Pain is both perception and reaction and those of us who practice dentistry know this better than perhaps any other specialty. You can have a tiny insult with outside reaction or you can have someone with a broken jaw who waltzes in saying "it stings a bit."

Deleted: interest

investigation team to collect salivary evidence

APPENDIX 3
Checklist for Evidence Collection from Questioned Bitemarks

1. Initial Steps

a. Case data documentation

i. Identification data

- Case agency
- Case number
- Examiner

ii. Pattern location data

- Anatomical location
- Surface contour
- Tissue characteristics
- Object (medium) description, if not human skin

iii. Pattern or patterned injury features data

- Size
- Shape
- Nature (abrasion, contusion, laceration, avulsion)
- Other (3D features, indentations, incisions, unusual features)

iv. Pattern description data

- Orientation of maxillary/mandibular dental arches (if visible)
- Locations of midlines (if visible)
- Individual tooth marks
- Unmarked areas
- Features indicating tooth rotations, translations, or anomalies
- Summary of overall features

b. Orientation photographs

- Orientation images exposed prior to other evidence collection to document characteristics of the person or object, the case number and date, and anatomical location(s)

c. Swabbing

- If not completed by other investigators, each bitemark swabbed for DNA following proper protocols for the jurisdiction. If there is no jurisdictional protocol, the double-swab method is used

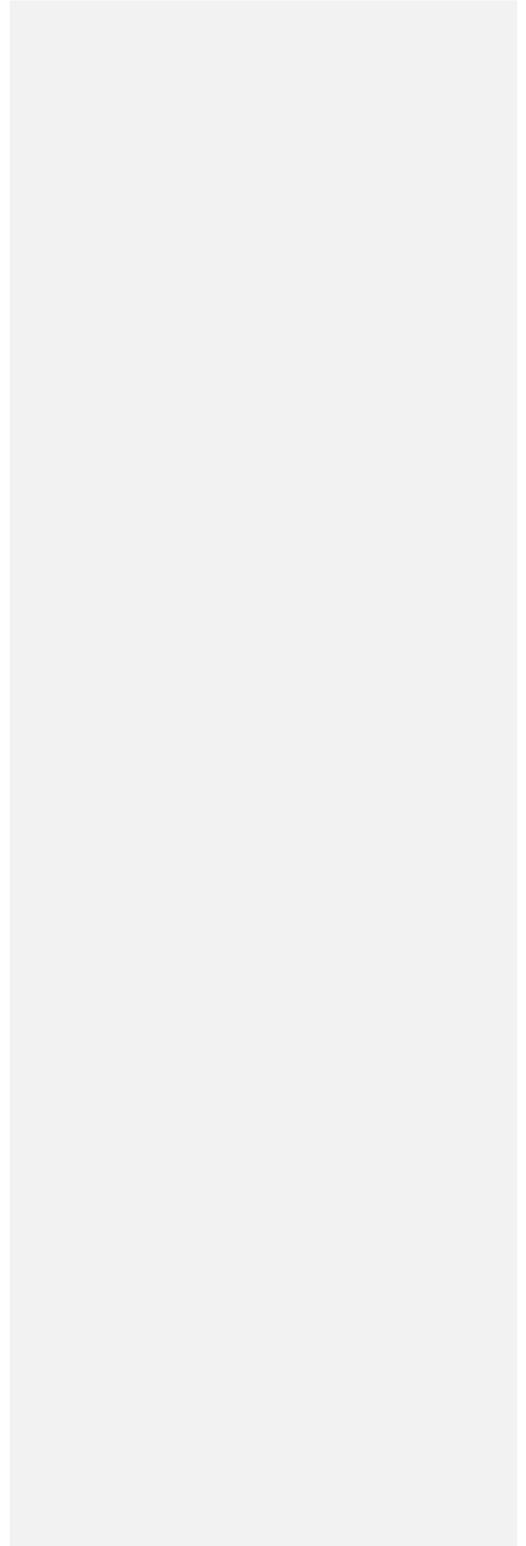
2. Photography

- High-quality digital camera used. Photographic procedures are performed by or under the direction of the forensic odontologist if the odontologist only has access to an iphone, does this preclude taking the images. I realize this is a check list but an image from a lesser quality camera can beat no image
- Appropriate ambient or artificial lighting (or both) utilized What's the definition here?

Commented [RW60]: Some of the new camera phones are pretty damned good.

| [What is appropriate? Dark room and mega bright flash?](#)

- Overall orientation images then progressively closer images exposed of each bitemark



- Images of sufficient resolution for enlargement to life-size without pixilation hopefully
- Photographs exposed without and with a properly placed and labeled ABFO No.2© reference scale If the investigator doesn't have an ABFO #2 scale, he/she doesn't take the images? Wouldn't any reference scale work as long as that same scale was available for later sizing?
- Reference scale is a) in the same plane as, and b) adjacent to the portion of the pattern or patterned injury being imaged
- Camera sensor and lens face are parallel to both the plane of the reference scale and the plane of the pattern being imaged
- On curved or compound curved surfaces, multiple images are exposed with the camera sensor, lens face, reference scale, and the pattern in the same plane
- For a living person or person recently deceased, sequential photographs of the injury over time

When indicated, in addition to conventional visible light photographs, Infrared (IR), Ultraviolet (UVA), or Alternative Light Source (ALS) images are exposed This is a redundant comment by me, but what does "when indicated..." mean? There is no guidance. Maybe this should say "When available..."

- Video imaging *in addition* to conventional still photography as indicated

3. Impressions

- Impressions of the surface containing the pattern or patterned injury when 3D properties are present using ADA-listed materials and named in the report, including lot number and expiry date
- Impressions of the dentition of the person with the bitemark to assess possibility of self-inflicted bite or to determine if they may have also bitten another person
- Suitable support provided for the impression material I think this means a backing of some sort
- Impressions are poured using manufacturer's instructions and casts are labeled and retained following appropriate chain of custody Impressions are not poured. Dental stone is.

4. Chain of Custody

- Evidence received, collected or developed is clearly documented using appropriate chain of custody showing the case name and number, time and date of delivery, an inventory of the evidence delivered, and from whom the evidence was received along with his/her signature
- Similarly document any release of evidence by the odontologist

APPENDIX 4
Checklist for Evidence Collection from Dentitions of Persons of Interest

1. General Considerations

- Ensure appropriate search warrant, court order, or legal consent has been obtained
- Copies of these documents are retained as part of the case record
- Impressions of the dentition of the person with the bitemark to assess possibility of self-inflicted bite or to determine if they may have also bitten another person
- Another dentist collects dental evidence from persons of interest and foils. Blinded exemplars are provided to the odontologist for analysis but identities of persons contributing exemplars are not released.

2. Evidence Collected Should Include

- Demographic and other information specific to the subject
- Dental treatment records, if available

Photographs – to the greatest extent possible, photo documentation includes:

A. Extraoral photographs

- Full face
- Right and left three-quarter profiles
- Right and left profiles

B. Intraoral photographs (with retractors and mirrors as needed)

- Anterior view in centric occlusion
- Anterior view with incisal edges slightly opened
- Anterior view with mandible protruded
- Anterior view demonstrating maximal opening
 - With reference scale
 - Without reference scale

- Lateral views, both right and left sides
- Occlusal views of each arch

C. Additional images in the suspect dentition evidence collection section, it states test bites from models...this is a conflict (I concur)

- Maxillary and mandibular surfaces of test bites with and without reference scale
- shouldn't each of these test bites be required to be labeled so they can be differentiated and authenticated? Video imaging in addition to conventional still photography as indicated

Intraoral examination

A. Condition of the teeth

- Missing teeth
- Fractured teeth
- Mobile teeth

B. Condition of the periodontium

C. Presence of maxillary and/or mandibular tori

D. Presence of tongue and/or lip piercings and jewelry

E. Other unusual intraoral features or anomalies\

Impressions

- Maxillary and mandibular impressions taken with ADA-listed materials using

Commented [RW61]: So if you don't have ALL this are we going to refrain from offering an opinion??? Because I would venture to say none of us do this entire list.

- appropriate dental impression materials
- If removable prostheses are present, impressions made both with and without the prosthetic appliances *in situ*

- Inter-occlusal relationship recorded using approved materials and techniques
- I'm afraid I still haven't seen the description of acceptable materials and what techniques to use. For example, when making a test bite insitu with a suspect dentition using CoprWax, it's important to instruct the suspect dentition's owner not to bite all the way through the wax as it will severely distort the position, size shape and alignment of the teeth.
-

Alternate impressions using approved intraoral 3D scanners as needed
Sample or test bites recorded using appropriate ADA-listed materials and techniques, and these records photographed and retained

Dental casts

- Master casts prepared from impressions using ADA-approved Type III dental stone following manufacturer's instructions and accepted techniques.
- Master casts may also be made using approved materials from 3D scans as needed.

Swabbing

- If not completed by other investigators, buccal swabs should be collected and stored following established protocols
For both DNA and amylase

APPENDIX 5
Checklist for Second Opinions in Bitemark Evidence Cases

1. Case identifiers
 - Name and/or identifier recorded of person or object bitten
 - Notation of dentitions of persons of interest and foils blinded
 - Status of recipient of patterned injury noted
 - Alive when injury occurred and alive when evidence collected
 - Alive when injury occurred and deceased when evidence collected
 - Deceased when injury occurred
2. Requesting agency
 - Name of agency noted
 - Case contact person and title at agency noted
 - Date of retention noted
 - Chain of custody documented
3. Dates
 - Date questioned bitemark made noted, if known
 - Date of initial evidence collection procedures noted
 - Dates of additional evidence collection procedures noted
4. Examination and documentation of questioned bitemark
 - Date, Place, & Time of examination noted
 - Others present at examination noted
 - Other experts or consultants used noted
 - Description of the bitemark
 - Anatomic location of mark noted
 - Size and shape of mark noted
 - Type of tissue involved or type of medium if not human tissue noted
 - Documentation (photographic and other) appropriate for the nature of the injury
 - Exceptions noted in case specific comments below
 - ABFO terminology used to describe whether or not the pattern is a bitemark
 - Evidentiary value considered to support proceeding to comparison of bitemark(s)
 - Dentition cast acquisition and production techniques documented
 - Dental line-up utilized
 - Approved comparison technique(s) used
 - Other comparison techniques used
 - ABFO linkage terms used
 - Appropriate blinding procedures used
 - 2nd Opinion written report produced following ABFO report writing guidelines

Case specific comments:
