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OSAC 2024-S-0013

Standard for Photographing Dental Evidence

Forensic Odontology Subcommittee
Medicine Scientific Area Committee (SAC)
Organization of Scientific Area Committees (OSAC) for Forensic Science



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DRAFT OSAC Proposed Standard

OSAC 2024-S-0013 Standard for Photographing Dental Evidence

Prepared by
Forensic Odontology Subcommittee
Version: 1.0
June 2024

Disclaimer:

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59 selected group is tasked with evaluating the proposed standard based on a defined list of
60 scientific, administrative, and quality assurance based criteria.

61 For more information about this important process, please visit our website
62 at: [https://www.nist.gov/organization-scientific-area-committees-forensic-science/scientific-](https://www.nist.gov/organization-scientific-area-committees-forensic-science/scientific-technical-review-str-process)
63 [technical-review-str-process](https://www.nist.gov/organization-scientific-area-committees-forensic-science/scientific-technical-review-str-process)

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97 **Foreword**

98 This document is a draft of a standard developed by the Subcommittee of the Organization of
99 Scientific Area Committees (OSAC) for Forensic Science.

100

101 The following applies to this document:

102 The term '**shall**' indicates that a provision is mandatory and can be audited for compliance.

103 The term '**should**' indicates that a provision is not mandatory but recommended as good practice.

104

105 All hyperlinks and web addresses shown in this document are current as of this Standard's
106 publication date.

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138 **Keywords:** *forensic odontology, training, education, minimum requirements*

139

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149 **Standard for Photographing Dental Evidence**

150 **Preface**

151 Photographs are often the first and only means of recognizing and analyzing dental evidence. If
152 properly recorded, documented, and archived, the photograph(s) can be used for analysis.

153

154 **1 Scope**

155 This standard defines the requirements and implementation for the photographic
156 documentation of dental evidence and provides guidelines to achieve those requirements.

157

158 **2 Normative References**

159 There are no normative references.

160

161 **3 Terms and Definitions**

162 **3.1**

163 **aperture**

164 Adjustable opening in a camera lens through which light passes to the sensor.

165

166 **3.2**

167 **clarification**

168 Any process intended to show the content and detail more clearly within a digital image
169 without changing the content of the image.

170

171 **3.3**

172 **close-up photograph**

173 Photograph taken within the minimum distance required to fill the frame with the subject
174 matter.

175

176 **3.4**

177 **color temperature**

178 Every light source has a temperature measured in Kelvin degrees.

179

180 **3.5**

181 **depth of field**

182 Area in a photo that appears sharp, which extends both in front of and behind the Point
183 of Critical Focus.

184

185

186

- 187 **3.6**
188 **exposure**
189 Amount of light reaching a camera sensor when the shutter release is activated,
190 controlled by a combination of shutter speed, aperture, and ISO setting.
191
192 **3.7**
193 **examination quality photograph**
194 Close-up photograph with a properly placed forensic scale.
195
196 **3.8**
197 **flat lighting**
198 Light that directly illuminates the subject matter from the camera position resulting in
199 minimal or no shadows.
200
201 **3.9**
202 **gray card**
203 Card used to establish a color balance that is designed to represent 18% gray in color.
204
205 **3.10**
206 **histogram**
207 Visual tool that uses a graph to show the tonal values in an image.
208
209 **3.11**
210 **image enhancement**
211 Any process intended to improve the visual appearance of an image or specific features
212 within an image.
213
214 **3.12**
215 **image processing**
216 Clarification of an image without altering its content.
217
218 **3.13**
219 **illumination**
220 Amount of light falling on a surface.
221
222 **3.14**
223 **interpolation**
224 Recalculating of pixel values due to the resampling of the pixels when changing the size
225 of an image or rotating an image in a non-90-degree angle.
226
227

228 **3.15**
229 **lossless compression**
230 Compression in which no data is lost and all data can be retrieved in their original form.

231
232 **3.16**
233 **macro lens**
234 Prime lens designed with flat field optics that eliminates or minimizes optical distortion
235 and has a small minimum focusing distance that facilitates the capturing of life-sized, or
236 1:1, photographs.

237
238 Note to entry: Zoom lenses labelled as “macro” are not true macro lenses, and only allow
239 a close focus capability.

240
241 **3.17**
242 **medium view photograph**
243 Photograph composed to show a view of both the area of interest and a recognizable
244 feature or landmark that enables the viewer to determine the location of the area of
245 interest.

246
247 **3.18**
248 **native ISO**
249 Identifies the range of ISO settings built into a camera.

250
251 **3.19**
252 **normal focal length**
253 Lens with a field of view that closely represents the human eye.

254
255 Note to entry: normal focal length is dependent on sensor size. For full-frame cameras
256 this is 35-60mm and for Advanced Photo System type-C(APS-C) it is 30-40mm.

257
258 **3.20**
259 **oblique lighting**
260 Light source positioned at a low angle to the subject matter to create contrast and show
261 detail by creating shadows on a raised surface.

262 Note to entry: also known as cross-lighting

263
264 **3.21**
265 **optical distortion**
266 Distortion caused by lens design resulting in straight lines appearing curved

267
268

269 **3.22**
270 **perspective distortion**
271 Deformation of the subject matter image caused by incorrect camera positioning (i.e., the
272 camera and lens not being parallel to or too close to the subject matter).

273
274 **3.23**
275 **point of critical focus**
276 Precise location where the camera focus point is placed,

277
278 **3.24**
279 **prime lens**
280 Lens with a focal length that is not adjustable.

281
282 **3.25**
283 **proper exposure**
284 Exposure setting that reproduces the subject with tonal values that match the actual
285 subject.

286
287 **3.26**
288 **through-the-lens flash (TTL flash)**
289 Flash mode measuring the light reaching the camera sensor and controls the duration of
290 the flash to obtain a proper exposure.

291
292 **4 Requirements for an Evidentiary Quality Image**

293 There are five essential requirements necessary to obtain evidentiary quality images:

- 294 1) Good lighting
295 2) Proper exposure
296 3) Sharpness
297 4) Proper composition
298 5) Accurate color

299
300 **4.1 Lighting**

301 The area being photographed shall be lit in the following manner:

302 **4.1.1** The type of light shall be appropriate for the subject matter.

303 **4.1.1.1** The light should be bright enough to allow a small aperture to be used that will allow a
304 depth of field that clearly shows the entire area of interest.

305
306 **4.1.1.1.1** Flash is preferred because it provides a more powerful illumination than a continuous
307 light source.

308 **4.1.1.1.2** Continuous light sources, including LED lighting, can be uncomfortably bright and
309 potentially hot to a live subject due to the intensity required for an adequate depth of field.

310

311 **4.1.1.2** Flash should always be used for live subjects.

312 **4.1.1.3** Flash or continuous light sources are acceptable when working with corpses or fixed
313 objects.

314

315 **4.1.2** The light shall provide an even illumination of the area of interest.

316 **4.1.2.1** The light should be diffused or used in a manner to avoid hotspots or dark areas in the
317 photograph.

318

319 **4.1.3** The direction of the light should illustrate the detail of the dental evidence.

320 **4.1.3.1** Oblique lighting is preferred to flat lighting to better show depth in the dental evidence.

321 **4.1.4** The color of the light shall be coordinated with the color balance setting in the camera.

322 **4.1.4.1** The white balance setting in the camera shall be set to automatic or the same color
323 temperature as the light source (i.e., the camera's white balance should be set to flash when
324 using a flash.)

325

326 **4.1.4.2** A gray card or scale with 18% gray should be used to allow for accurate color balance in
327 post-processing.

328

329 **4.1.5** There should be no harsh shadows.

330 **4.1.5.1** To portray depth, shadowed areas should be sufficiently illuminated to avoid obscuring
331 detail.

332

333 **4.2** Exposure

334 Most cameras will provide an accurate *exposure* when using a flash and metering in the *TTL* flash
335 mode. However, both proper and improper settings can still result in unacceptable exposures.

336

337 **4.2.1** The camera shall be used in either the Aperture Priority mode or Manual Mode.

338 **4.2.1.1** Only these two modes offer full control for capturing all the required elements of an
339 evidentiary quality image.

340

341 **4.2.2** The camera's lowest native ISO setting shall be used.

342 **4.2.2.1** The lowest native ISO is typically ISO 100 or ISO 200 in some cameras.

343 **4.2.3** An aperture setting of no less than f/8 shall be used.

344 **4.2.3.1** Optimal aperture setting of no less than f/8 shall be used.

345 **4.2.4** The camera histogram should be monitored to ensure proper exposure.

346 **4.3** Sharpness

347 Obtaining a sharp image requires the following:

348 **4.3.1** An aperture shall be used as previously described in subsection 4.2.3.

349 **4.3.2** The lowest native ISO should be used as previously described in subsection 4.2.2.

350 **4.3.3** There should be no subject movement.

351 **4.3.4** There should be no camera movement.

352 **4.3.5** The correct type of lens should be used:

353 **4.3.5.1** When possible, a prime macro lens should be used.

354 **4.3.5.1.1** A normal focal length macro lens is preferable over a telephoto macro lens.

355 **4.3.5.2** If a zoom lens is used, the focal length shall be set to a normal focal length.

356 **4.3.6** A macro filter or close-up diopter shall not be used.

357 **4.4** Composition

358

359 Composition requirements will vary based on the type of photograph as follows:

360

361 **4.4.1** All photographs of the dental evidence and scale shall be “square” to the camera’s
362 viewfinder.

363

364 **4.4.1.1** When using an ABFO No 2 scale, one side of the scale should be parallel to the bottom or
365 top of the viewfinder, and the other side should be parallel to the side of the viewfinder.

366

367 **4.4.1.2** Straightening an image that is not square to the viewfinder during post-processing will
368 introduce additional pixels through interpolation.

369

370 **4.4.2** All photographs of dental evidence shall be taken as parallel to the camera sensor as
371 possible to minimize perspective distortion.

372

- 373 **4.4.3** All photographs of dental evidence should be oriented to match the orientation of the
374 viewfinder in the camera.
375
- 376 **4.4.4** A medium view photograph should adequately reveal the location of the dental evidence.
- 377 **4.4.4.1** The medium view photograph should not include areas that are not needed to determine
378 the location.
379
- 380 **4.4.5** An examination quality photograph of the dental evidence shall only show the area of
381 interest.
382
- 383 **4.4.5.1** The scale shall be on the same plane as the dental evidence.
- 384 **4.4.5.1.1** If the scale is not at the same plane as the dental evidence, using that scale for
385 measurement purposes shall not be done.
386
- 387 **4.4.5.2** The scale shall be oriented in the same manner as the dental evidence and aligned with
388 the edges of the camera viewfinder.
389
- 390 **4.4.6** A close-up photograph shall be taken of the dental evidence showing only the area of
391 interest.
392
- 393 **4.4.6.1** The close-up photograph should fill the frame with the dental evidence, i.e., there should
394 not be excess space around the area of interest.
395
- 396 **4.4.6.1.1** An exception is when an additional depth of field is required, which may be necessary
397 with a moving subject or dental evidence on a curved surface.
398
- 399 **4.4.6.1.1.1** Moving further away from the subject matter increases the depth of field.
- 400 **4.4.6.1.1.2** The image can then be cropped during post-processing to include only the dental
401 evidence.
402
- 403 **4.4.7** If dental evidence is on a curved surface, no less than three photographs should be taken.
- 404 **4.4.7.1** The scale shall be kept parallel to the camera sensor.
- 405 **4.4.8** A forensic scale should always be used for an examination quality photograph.
- 406 **4.4.8.1** The ABFO No.2[®] scale (Lightning Powder Co, Inc) was created specifically for this
407 application.
408
- 409 **4.4.8.1.1** Many versions of this scale are available, and the accuracy of those scales can vary
410 and should be verified.
411

412 **4.4.8.1.2** Other scales designed for forensic applications are available.

413 **4.5** Accurate Color

414 Accurate color should be the goal when examining quality photographs.

415 **4.5.1** Accurate color should be obtained with each image.

416 **4.5.1.1** Accurate color can be achieved by using a white balance setting in the camera that
417 matches the color of the light source when taking the photograph.

418

419 **4.5.1.2** Accurate color can also be obtained through image processing software by first
420 photographing a gray card captured under identical lighting conditions.

421

422 **4.5.1.2.1** Using an 18% gray card is the most dependable technique; an ABFO No2© scale has
423 the 18% grayscale included on the scale.

424

425 **4.5.2** Every light source has a temperature that can cause a color tint in a photograph,
426 measured in Kelvin degrees.

427

428 **5 Workflow**

429 **5.1** Image Capture

430

431 **5.1.1** All images shall be taken in a lossless compression image format or the highest resolution
432 JPEG format available on the camera.

433

434 **5.1.1.1** Raw files are preferred over the TIFF format for an uncompressed image; raw files are
435 much smaller and contain complete information.

436

437 **5.1.1.2** There are two settings to ensure the highest resolution JPEG is captured:

438

439 **5.1.1.2.1** Compression: the least amount of compression should be used, typically listed as
440 “Low” or “Fine.”

441

442 **5.1.1.2.2** File size: the largest file size should be used, typically listed as “Large.”

443

444 **5.1.1.3** An image log should be completed that lists each image and describes what that image
445 purports to show.

446

447 **5.1.1.4** Images shall not be deleted; misfires and other unacceptable frames should be kept and
448 noted on the image log.

449

450 **5.2** Image Processing

451

452 **5.2.1** Original images shall be uploaded to a secure computer hard drive.

453

454 **5.2.1.1** Original images shall not be processed or changed in any manner.

455

456 **5.2.2** Only copies of original images shall be processed.

457

458 **5.2.3** Processing images should only be done by someone trained to use the tools provided in
459 the image processing software.

460

461 **5.2.4** During processing, no changes to the content of an image shall be made.

462

463 **5.2.5** All the steps taken to process an image shall be documented.

464

465 **5.2.5.1** An alternative to manually documenting each step is to use the detailed history log
466 available in software programs, such as Adobe Photoshop.

467

468 **5.2.6** A processed image shall be saved in a lossless file format, either “PSD” (Photoshop),
469 “TIFF,” or “PNG.”

470

471 **5.2.6.1** This image file can also be described and referred to as a “working file.”

472

473 **5.3** Image Outputs

474

475 **5.3.1** Processed images should be converted and downsized to a lossy file format:

476

477 **5.3.1.1** JPEG is typically preferred and can be viewed on any device.

478

479 **5.3.1.2** Image down-sizing is recommended that will match the end-use, e.g., pixel dimensions of
480 the output image should not exceed:

481

482 **5.3.1.2.1** The resolution dimensions of a high-resolution computer monitor.

483

484 **5.3.1.2.1.1** The pixel dimensions of 2500 pixels per inch (PPI) on the long side will generally
485 suffice.

486

487 **5.3.1.2.2** The size required to make an appropriately sized print.

488

489 **5.3.1.2.2.1** Most printing sources and programs will provide the necessary dimensions and
490 PPI for the desired print size.

491

492 **5.4** Image Storage

493

494 **5.4.1** Both original images and copies of those images shall be backed-up to a secure separate
495 drive or storage media system.

496

497 **5.4.1.1** Each time an image working copy is changed, it should be backed-up.

498

499 **5.4.2** Both original images and copies of those images should also be backed-up off-site, either
500 to a secure remote server or secure cloud storage.

501

502 **5.4.3** All images shall reside on a secure system with restricted access to protect the chain of
503 evidence.

504

505 **5.4.3.1** Anyone granted access to those images shall be noted with a description of any action
506 taken when doing so.

507

508 **5.4.4** Images shall not be stored on the memory card or other capture device.

509

510 **6 Legal Requirements**

511 **6.1** When applicable, maintain HIPAA compliance and uphold patient privacy regulations.

512

513 **6.2** These recommendations may not cover some legal requirements specific to the local
514 jurisdiction; therefore, it is crucial to know local laws and procedures to ensure compliance with
515 the jurisdiction's regulations.

516

517