



Computational Photography: Future and Challenge for Dental Photography



One of the areas in which technology has made a significant impact is photography—more precisely, computational photography, a new term that we all should be aware of. This concept is being driven by smartphone manufacturers, not by the traditional camera manufacturers. The convenience of a relatively small device with impressive computational abilities has prompted the development of novel features that are revolutionizing how we take or make photographs. The megapixel camera war continues, as newer smartphones have cameras up to 108MP. Even though some smartphones may produce high-resolution files, many manufacturers default to the pixel-binned resolution to decrease phone storage. However, due to the small sensor size, noise is still an issue with smartphone cameras. Thus, digital technology was employed to improve this shortcoming, but it went even further. Computational technology is now able to control the illumination of a scene through algorithms that can relight, enhance, and/or blur the whole or parts of an image. With some smartphone cameras, by the time one presses the shutter button the camera has acquired numerous frames at long exposure, fast shutter speed, and standard speed, in addition to the intended shot. All those files are then merged, analyzed, and processed for noise and details, pixel by pixel, to generate the final image. Human skin/hair receives the highest level of detail, whereas other areas of the image receive less attention. Apps are now available with the power to

access, modify the original depth of field, and refocus almost any image. All of us who do intraoral photography understand clearly how all the aforementioned features would be a great ally to our photographic skills.

The quality of smartphone videos also has significantly improved, with 4K video resolution now available for most smartphones. But more impressive is the extended dynamic range and the cinematic-like in-body video stabilization that some smartphones have available. In extended dynamic range mode, the camera is actually taking dual-exposure videos at a normal exposure frame together with a short exposure frame (for instance, 120 and 60 frames per second) and combining them on the spot to create a single frame without any further processing. Moreover, smartphone apps are capable of creating 3D face scans that can be exported as STL or OBJ files.

With all this technology in everyone's hands, it is no wonder that the digital camera market continues to shrink. The Camera & Imaging Products Association (CIPA) has reported a huge drop in global digital camera shipments from 2017 to 2019, as well as a decline in sales for all major camera manufacturers.¹

Despite its features and convenience, photographing extra- and intraorally with a smartphone poses an ethical dilemma: Is it permissible to store patients' electronic protected health information (ePHI) on a personal device? In the United States there are strict regulations that safeguard patient health information (Health Insurance Portability and Accountability Act, HIPAA²), and dental practices are responsible for implementing policies to protect personal information. In 2006, the Health Information Technology for Economic and Clinical Health (HITECH) Act³ expanded the concept of ePHI protection and places liability on the practice to maintain HIPAA and HITECH compliance. The US Government has created a webpage with more information on privacy and security of using mobile devices, and it is worth your time to take a look.⁴

The digital disruption affects our personal and working lives almost every day, and the understanding of its power and, more importantly, its limits can only benefit our practices, patients, and treatments. I welcome you to experience the magnificent collection of opinions and techniques that challenge the boundaries between digital technology and dental art.

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¹http://www.cipa.jp/stats/documents/e/dw-201910_e.pdf

²<https://www.hhs.gov/sites/default/files/privacysummary.pdf>

³<https://www.hhs.gov/sites/default/files/ocr/privacy/hipaa/administrative/enforcementrule/enfifrr.pdf>

⁴<https://archive.healthit.gov/providers-professionals/your-mobile-device-and-health-information-privacy-and-security>

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