

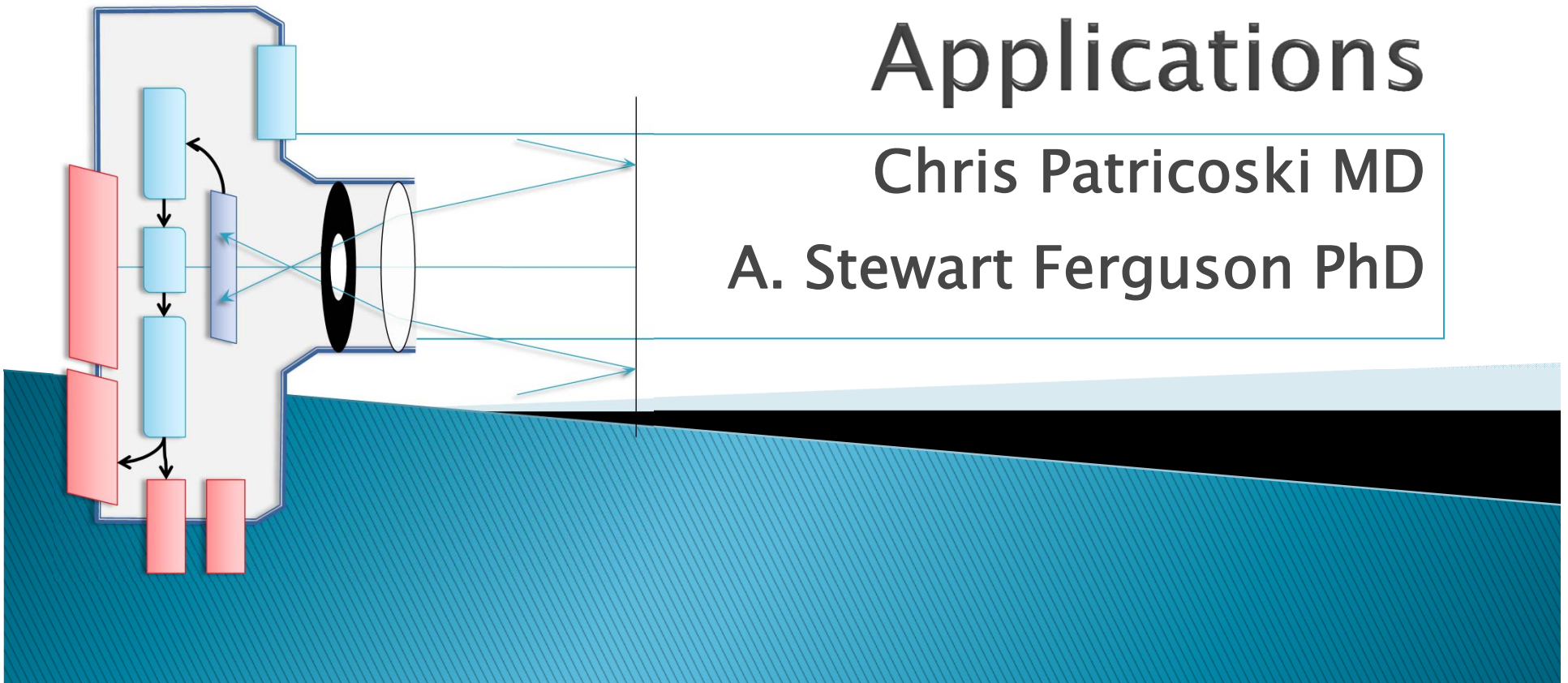


Alaska Native
Tribal Health Consortium



Selecting the Right Digital Camera for Telehealth Applications

Chris Patricoski MD
A. Stewart Ferguson PhD



Amazon.com Lists 2,062 Point-and-Shoot Cameras

771 cost \$100-\$200



A digital camera, dollar for dollar, is the most powerful telehealth peripheral

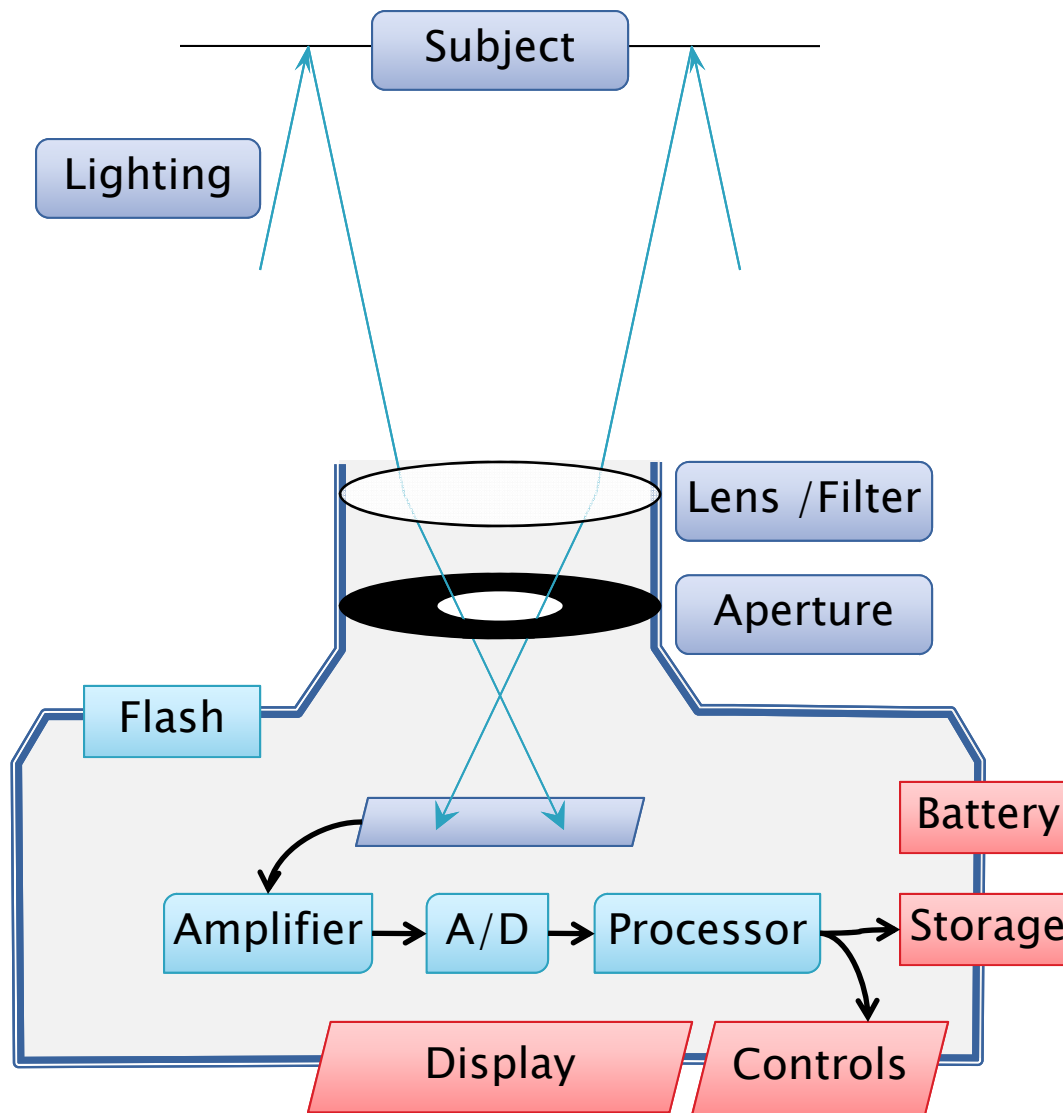
Especially true for remote and developing regions. It is a ubiquitous consumer device that virtually anyone can operate.



Digital Cameras: A Consumer Product

- ▶ Global demand for digital cameras to reach 111 million units in 2008
 - US digital camera market to reach 40 million in 2008
- ▶ Digital camera sales up 20%, revenues up 3%
- ▶ 67% of US households had digital cameras in 2006
- ▶ Film sales drop by 20% every year
- ▶ 90% of all professional photos taken in 2010 will be digital
- ▶ 15% of digital camera owners never delete any images
- ▶ 11% of Americans have more than 10,000 digital photos
- ▶ 80% of cameraphone owners also carry their digital camera





What Affects Image Quality?

1. Lighting
2. Subject
3. Lens / Filter
4. Aperture
5. Sensor (CCD)
6. Amplifier
7. A/D Converter
8. Processor
9. Storage
10. Controls
11. Display
12. Battery

ATA Guidelines

- I. Guidelines for the Practice of Tele dermatology
 - a. Technical Specifications
 - i. **Image Acquisition**
 - ii. Image Storage, Retrieval & Transmission
 - iii. Image Display
 - b. Clinical Specifications
 - i. **Practice Specifications**
- II. Recommendations for Best Practices
 - a. Technical Specifications
 - i. **Image Acquisition**
 - ii. Image Storage, Retrieval & Transmission
 - iii. Image Display
 - b. **Clinical Specifications**
- III. Optional Steps Towards Optimizing Tele dermatology Practices
 - a. Technical Specifications
 - i. **Image Acquisition**
 - ii. Image Storage, Retrieval & Transmission
 - iii. Image Display

AMERICAN TELEMEDICINE ASSOCIATION'S PRACTICE GUIDELINE FOR TELEDERMATOLOGY

Elizabeth Krupinski, PhD¹, Anne Burdick, MD, MPH², Hon Pak, MD³, John Bocachica, MD⁴, Lucius Earles, MD⁵, Karen Edison, MD⁶, Marc Goldyne, MD⁷, Tom Hirota, DO⁸, Joseph Kvedar, MD⁹, Karen McKoy, MD, MPH¹⁰, Dennis Oh, MD¹¹, Dan Siegel, MD¹², Nina Antoniotti, PhD¹³, Ivan Camacho, MD¹⁴, Lisa Carnahan¹⁵, Paul Boynton, PhD¹⁵, Richard Bakalar, MD¹⁶, Richard Evans, MS¹⁷, Al Kinel, PhD¹⁸, Peter Kuzmak, MSBME¹⁹, Brian C. Madden, PhD²⁰, Sandra Peters, PhD²¹, Lynne Rosenthal¹⁵, Scott Simmons, MS², Jordana Bernard²², Jonathan Linkous²²

¹Arizona Telemedicine Program University of Arizona, Tucson, AZ

²Associate Dean of Telemedicine and Clinical Outreach Miller School Medicine University of Miami, Miami, FL

³Chief, Advanced Information Technology Group Telemedicine and Advanced Technology Research Center, Ft. Detrick, MD

⁴Departments of Dermatology and Teledermatology Alaska Federal Health Care Access Network, Anchorage, AK

⁵Section of Dermatology Department of Medicine Mt. Sinai Hospital Chicago, IL

⁶Department of Dermatology University of Missouri Health Care, Columbia, MO

⁷Department of Dermatology University of California San Francisco, San Francisco, CA

⁸Dermatology Services Madigan Army Medical Center & Department of Dermatology F. Edward Hebert School of Medicine Uniformed Services University of Health Sciences, Bethesda, MD

⁹Center for Connected Health Partners HealthCare System, Inc. Department of Dermatology Harvard Medical School, Boston, MA

¹⁰Lahey Clinic Department of Dermatology Burlington, MA & Department of Dermatology Harvard Medical School, Boston, MA

¹¹Department of Dermatology University of California San Francisco & Dermatology Service San Francisco VA Medical Center, San Francisco, CA

¹²Department of Dermatology SUNY Downstate, Brooklyn, NY

¹³Marshfield Clinic TeleHealth Network Marshfield, WI

¹⁴Department of Dermatology and Cutaneous Surgery University of Miami, Miami, FL

¹⁵Information Technology Laboratory National Institute of Standards and Technology, Gaithersburg, MD

¹⁶IBM Global Healthcare IBM Corporation

¹⁷Utah Telehealth Network, Salt Lake City, UT

¹⁸Director of Alliances Kodak Corporation, Rochester, NY

¹⁹Department of Veterans Affairs VistA Imaging Project Silver Spring, MD

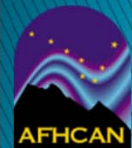
²⁰Program Director VISN 2 Telemedicine Department of Veterans Affairs & Department of Dermatology University of Rochester, Rochester, NY

²¹American Academy of Dermatology, Washington, DC

²²American Telemedicine Association

V1.2007

1



How do I select a camera?

J.D. Power and Associates 2008 Digital Camera Usage and Satisfaction StudySM



Note: The Point and Shoot segment consists of traditional fixed lens cameras with a depth greater than one inch and an average sale price of less than \$250.

Included in the study but not ranked due to small sample size are: HP Photosmart E Series, HP Photosmart R Series, Nikon Coolpix Life (L) Series, Polaroid I Series and Samsung L Series.

Power Circle Ratings Legend

- 5 (Among the best)
- 4 (Better than most)
- 3 (About average)
- 2 (The rest)

Source: J.D. Power and Associates 2008 Digital Camera Usage and Satisfaction StudySM

Charts and graphs extracted from this press release must be accompanied by a statement identifying J.D. Power and Associates as the publisher and the J.D. Power and Associates 2008 Digital Camera Usage and Satisfaction StudySM as the source. Rankings are based on numerical scores, and not necessarily on statistical significance. JDPower.com Power Circle RatingsTM are derived from consumer ratings in J.D. Power studies. For more information on Power Circle RatingsTM, visit jdpower.com/flags. No advertising or other promotional use can be made of the information in this release or J.D. Power and Associates survey results without the express prior written consent of J.D. Power and Associates.

▶ Highest Rating?

- “The Fujifilm Finepix S series ranks highest in the point and shoot segment ... performing particularly well in picture quality, performance and ease of operation.”

▶ Market Leader?

- “Canon held onto the lead in market share for the third consecutive year with 23%, while Sony had an 18% share, and Kodak had 16%.”

▶ Brand loyalty?

- “34% of US digital camera owners are repeat digital camera buyers .”

▶ Megapixels

▶ Pre-sales information?

Source: www.ifacts.biz



Marketing Strategies

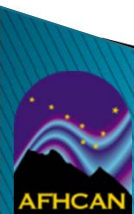
- ▶ **MegaPixels (MP)**
 - Most telehealth is conducted using 0.3 MP
- ▶ **Gorgeous Outdoor Shots**
 - Fluorescent or Incandescent Lighting
- ▶ **Awesome Battery Life**
 - Average Number of Pictures/Encounter: 3



- ▶ **Compact Size**
 - Stolen – Lost – Misplaced – Dropped
- ▶ **Scene Modes, Face Detection, Digital Zoom**
 - May not apply

Our Approach

- ▶ **BUDGET**
 - Determine how much you are willing to spend
- ▶ **ESTABLISH REQUIREMENTS**
 - e.g. Power System, Docking station, Macro
- ▶ **MARKET REVIEW, LEARN, RESEARCH**
 - Hit web pages, reviews, visit stores
- ▶ **PURCHASE, BEG, BORROW or ~~STEAL~~ TEST UNITS**
 - Cameras with closed match to requirements
- ▶ **TEST**
 - e.g. Image Quality, UAT, Integration
- ▶ **PRODUCTION**
 - Volume Purchase, Integrate, Curriculum, Assembly, Ship, Train, Support.



Source: Long, B., Complete Digital Photography, (c) 2007.



Note...

Clinical (Telehealth) Images are **Different** from Consumer Images

- ▶ Target of Interest
- ▶ Provide Perspective
- ▶ Multiple image of same subject – close / far
 - Macro Mode
 - Locate on body with distal image
- ▶ Symmetric body parts
- ▶ Skin tones
- ▶ Wet surfaces
- ▶ Tight spaces
- ▶ Corner cases
 - Microscope
 - X-rays
- ▶ Motion Artifact



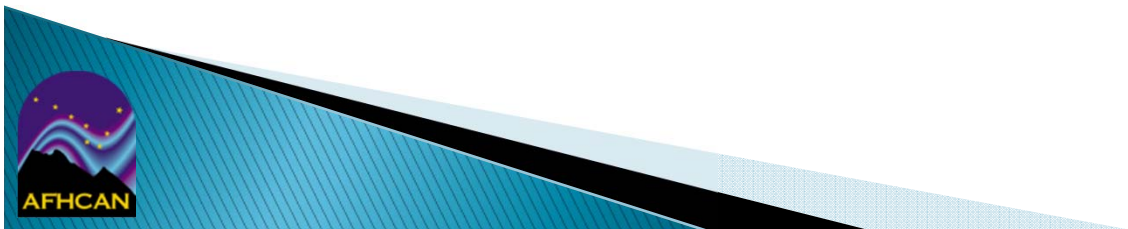
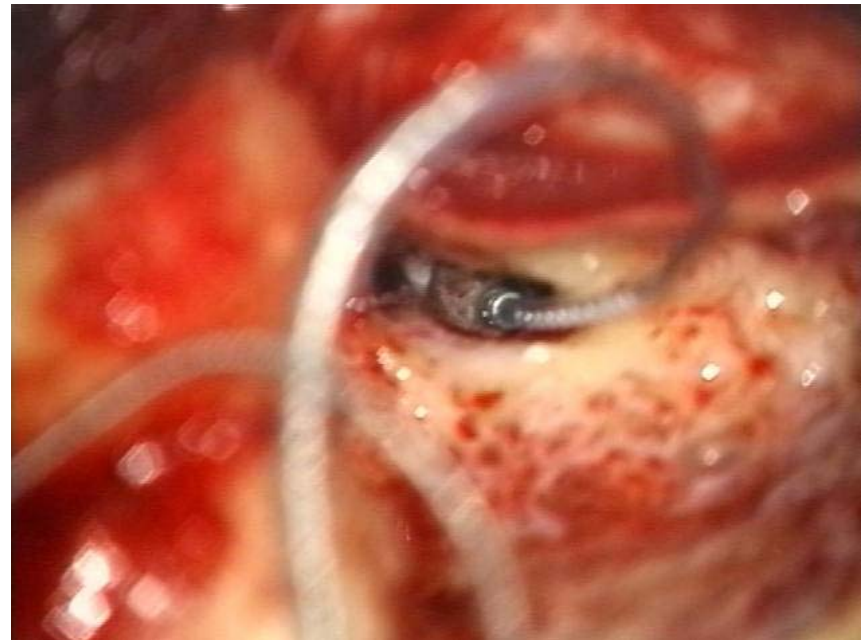
Macro Mode



Skin Tones



Wet Surfaces. Narrow Locations.



Targeted Lighting



Perspective



So just maybe

Select a Digital Camera according to your Needs and Requirements

Who will be using the camera?

What will they be using it for?



Know your USER(S)

To thine own self be true

- ▶ **User Volume**
 - How many users?
- ▶ **Frequency of Use**
 - How often will user(s) touch the camera?
- ▶ **Setting**
 - Clinical environment and “remoteness”
- ▶ **Interface**
 - How will user(s) download images?
- ▶ **Skill Level**
 - How adept with technology and imaging techniques?



Know your APPLICATIONS(s)

What are we trying to do?

- ▶ **Dermatology**
 - Skin and associated lesions
- ▶ **Primary care**
 - Skin, wound, burns and x-ray imaging
- ▶ **Dental and ENT**
 - Intra - oral imaging of moist mucous membranes and teeth
- ▶ **Surgery**
 - Skin, blood, and moist anatomical landmarks such as vessels, nerves, organs, etc.
- ▶ **Pathology**
 - Adaptation to a microscope and imaging of slides with specific color and lighting needs
- ▶ **While the purpose of the application is usually for diagnosis and treatment, there may be another purpose that guides your selection, such as quality assurance or documentation.**





ESTABLISH REQUIREMENTS

How will these decisions affect testing and other processes?

Requirements

- ▶ Image Quality
- ▶ Macro Capability
- ▶ Flash / Lighting
- ▶ Ease of Use
- ▶ Size / Format
- ▶ Power System
- ▶ Image Transfer
- ▶ Video Capture
- ▶ Cost
- ▶ Reliability
- ▶ Advanced Features



How will I test cameras to meet these requirements?

Image Quality

▶ Subject

- What will you be taking pictures off? Skin? Blood/Wet?
- These should be your test subjects.

▶ How important is detail versus color accuracy?

- Color quality is influenced by lighting
- Image detail is related to resolution, compression, lighting, focus, clarity, and motion artifact.

▶ Can you say anything about pixels?

- What kind of display – and resolution? e.g. 1024x768
- Will you print out images?
 - What size? – think 200–300 ppi,
 - 50K Pixels per square inch \rightarrow 5x7 in = 35 * 50k = 1.8 MP
- What level of zoom (i.e smallest object in image field)?



How will I test cameras to meet these requirements?

Macro Capability

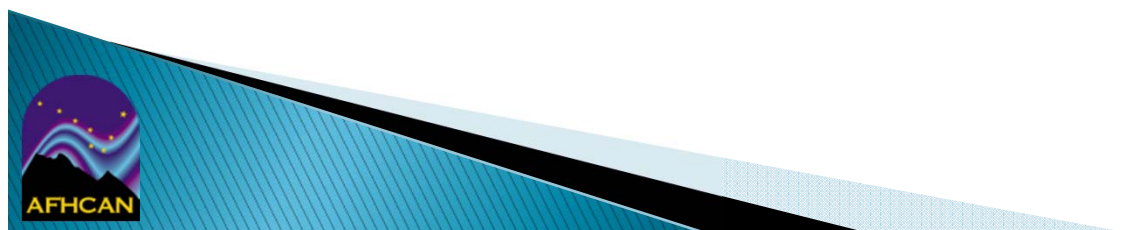
- ▶ How often will “macro” be required?
- ▶ What is your minimum area you need to image?
 - How close does the camera need to get to the subject?
- ▶ Does “macro” need to be easy to turn on/off?
 - Should macro mode persist after power cycle?



How will I test cameras to meet these requirements?

Flash / Lighting

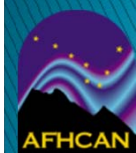
- ▶ **What is the lighting in your clinic?**
 - Type of “bulbs (temperature or wavelength)
 - Incandescent, Fluorescent, Full Spectrum, Daylight
 - Intensity – bright or dim?
- ▶ **Will lighting vary or will it be constant?**
- ▶ **Can you “condition” the lighting?**
 - e .g add accessory lights, change bulbs.
- ▶ **Do you expect to use flash?**
 - Do you have “confined clinical areas of interest”?



How will I test cameras to meet these requirements?

Ease of Use

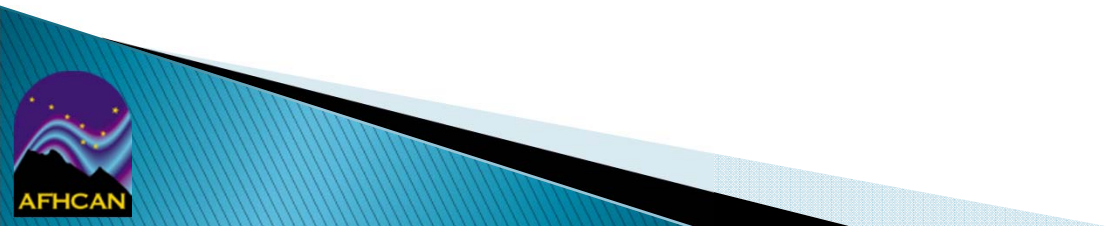
- ▶ **What are the capabilities of the user(s)?**
 - How many users?
 - Do they have experience with specific makes/models?
- ▶ **What features will be most often used?**
 - Most Important. Make sure these are readily accessible and “testable”:
 - On/Off, Auto Mode, Video Mode, Macro Setting, Flash Settings, Settings Menu, Image Review, and Image Delete
 - Less Important
 - Viewfinder, Zoom, Setting the timer, LCD display options, Attachment to a tripod.
- ▶ **What level of training can you provide?**
- ▶ **First impressions can be misleading.**



How will I test cameras to meet these requirements?

Camera Size, Format

- ▶ **Physical size of camera**
 - Small is not always good.
- ▶ **Uniqueness**
 - Color choices help
- ▶ **SLR vs Point-and-Shoot**
 - Simplicity versus features, control, and cost
 - Interchangeable lenses
 - Through the lens metering (e.g Nikon 990)



How will I test cameras to meet these requirements?

Power System

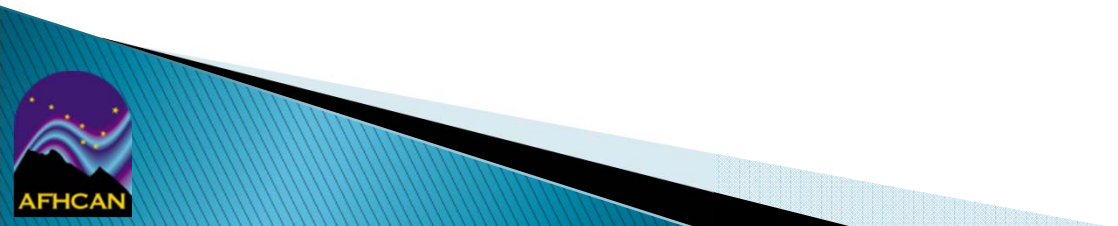
- ▶ **Are there specific needs for charging system?**
 - Charge while attached to PC through USB cable?
 - Charge through Docking station?
 - Run on external 120 VAC (e.g. microscope attachment)
 - Do you want to extract batteries to charge them?
- ▶ **Are there reasons to care about the type of battery?**
 - Custom rechargeable versus AA rechargeable versus disposable
- ▶ **How many photos need to be captured between charges?**
 - Portability issues: # patients, # images/patient



How will I test cameras to meet these requirements?

Image Transfer

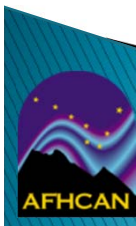
- ▶ **Are there specific needs for the storage media?**
 - Ease of insert/removal, Availability, Physical size, Capacity, Speed, Universality, Compatibility
- ▶ **Are there specific needs for data transfer?**
 - Removable media, USB, Docking Station, WIA, WiFi, other.
- ▶ **Are there specific needs or limitations depending on the computer application?**



How will I test cameras to meet these requirements?

Video Capture

- ▶ How often will this be used?
- ▶ Do you require specific characteristics of the video clip
 - Maximum duration
 - Video Quality and high fps (maybe even high def?)
 - Compression and File Size
 - Sound quality
- ▶ Video Format, Licenses, and version.
 - QuickTime, Windows AVI, etc.
- ▶ Additional Features
 - Change zoom or focus while recording?



How will I test cameras to meet these requirements?

Cost

Carefully consider all the costs associated with purchasing a digital camera

- ▶ Base Cost
- ▶ Accessories
 - Storage media
 - Docking station
 - Camera case
 - Tripod
 - High power or spare batteries
 - Battery charger
 - Lenses
 - External Flash
 - Cables
- ▶ Telemedicine software
- ▶ Training and Support
- ▶ Warranty and Replacement

How will I test cameras to meet these requirements?

Reliability

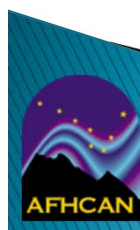
- ▶ ... of digital camera
 - Google for known issues
- ▶ ... of manufacturer
- ▶ ... of distributor
- ▶ ... of purchasing process
 - Availability
 - Check when first available.



How will I test cameras to meet these requirements?

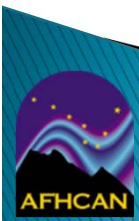
Advanced Features

- ▶ **Can you live with most or all of the auto/default settings?**
 - Does “Auto” mode provide sufficient control?
- ▶ **What will you be able to compensate for?**
 - Need to determine this prior to testing.
- ▶ **What settings can be retained when you turn the camera off and back on?**
- ▶ **How do the advanced settings affect image quality?**
- ▶ **What are the best settings for your clinical needs?**
 - Will you need to pre-program settings for a “Program” or “Manual” mode?



Digital Camera: Advanced Settings

Setting	Value
Color Mode (Saturation)	LOW COLOR
Face Detect Capture	OFF
Exposure Metering	CENTER SPOT
AF Zone	CENTER-ZONE
Maintain Settings	FLASH - NO WHITE BALANCE - YES ISO SPEED - YES COLOR MODE - YES SHARPNESS - YES EXPOSURE METERING - YES AF ZONE – YES
Orientation Sensor: Still	OFF
Digital Zoom	OFF
Video Size	HIGH QUALITY



Requirements meet Users

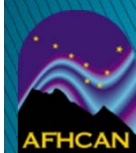
Requirement	Single Hi-Tech User	200 Remote Users
Image Quality	+++	++
Macro Capability	++	++
Flash/Lighting	-	+
Ease of Use	-	+++
Size / Format	-	+
Power System	-	++
Image Transfer	-	++
Video Capture	+	-
Cost	-	++
Reliability	+	+++
Advanced Features	+++	-





Market Review

What you do once you know your requirements



MARKET REVIEW

What's out there?

▶ We like:

- Manufacturer web sites
- www.imaging-resource.com
- www.neocamera.com
- www.dpreview.com
- www.myproductadvisor.com/mpa/home.do

▶ Read

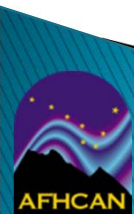
- Internet
- Emails

▶ Talk

- Local camera store
- Other users

▶ Try

- Box stores
- Friends, colleagues





Testing

Working towards a purchase decision.



Mimic the Clinical Environment

- ▶ Use a clinical environment (light, etc)
 - ▶ ... with clinical subjects
 - ▶ ... with clinical pathologies
 - ▶ ... with end users
 - ▶ ... with eventual camera settings !
-
- ▶ Require careful planning, analysis, and tools.
 - ▶ Document and capture information.



Steps in Testing Cameras

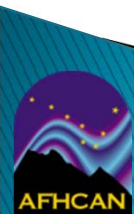
▶ PLAN

- Get ALL your test cameras first.
- Standardize cameras settings.
 - Play with each – to determine options and settings
 - Use “AUTO SETTINGS” unless otherwise justified.
 - Low compression? Flash auto? Image size?
- Develop a Test Plan
 - Determine “typical images” – where, what, how?
 - Plan for photographic subject, camera settings, and environment for each test.
 - e.g. Full face, macro off, flash auto, no zoom, fluorescent lighting, blue background.

▶ EXECUTE: Take pictures

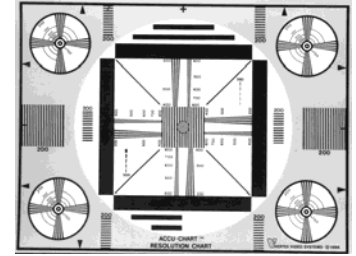
- Transfer, label and file.

▶ ANALYZE



Digital Camera: Image Testing

- ▶ **Multiple objects**
 - Hand, Face, Torso, Wound
- ▶ **Backgrounds**
- ▶ **Distance to Object**
- ▶ **Lighting**
 - Incandescent, Halogen, Fluorescent
- ▶ **Camera Settings:**
 - Flash on/off
 - Macro on/off
 - Image size and Compressions
- ▶ **Force operator errors**



Testing Image Quality

Hint

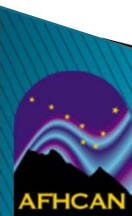
Once you have a “Gold Standard” or “Reference” Camera, you can test new cameras against those images

- ▶ **Begin with default setting on all cameras**
 - Make sure settings are not terribly different
- ▶ **Take photographs of the same subjects under the same lighting conditions**
- ▶ **Compare the images side by side**
- ▶ **Rate each image for**
 - Color
 - Detail
 - Ratings are made relative to the appearance of the true object (color)



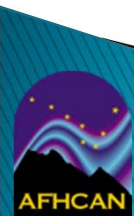
Record For Each Test Image ...

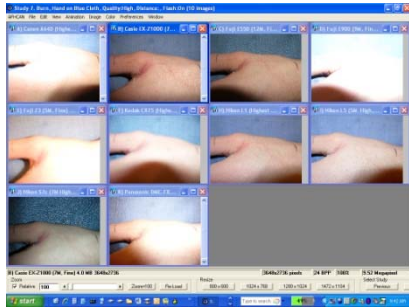
- ▶ Image Resolution (Megapixels)
- ▶ Compression Setting
- ▶ Flash Setting
- ▶ Flash Fired?
- ▶ Flash Level
- ▶ Optical Zoom Setting
- ▶ Macro Setting
- ▶ Background
- ▶ Lighting
- ▶ Distance to Object
- ▶ Object Description
- ▶ Subject
- ▶ Camera mounting system



Analysis Methods

- ▶ **Requires Scoring and Prioritization**
 - ... of what's important
- ▶ **Image Quality**
 - Objective (quantitative)
 - Image Detail (1 to 4)
 - Image Color (1 to 4)
 - May need to prioritize subjects or camera settings
 - e.g. always use (or don't use) the flash
- ▶ **Other Requirements**
 - Subjective or Objective
 - “Must have” versus “Nice to have” versus “Cute”

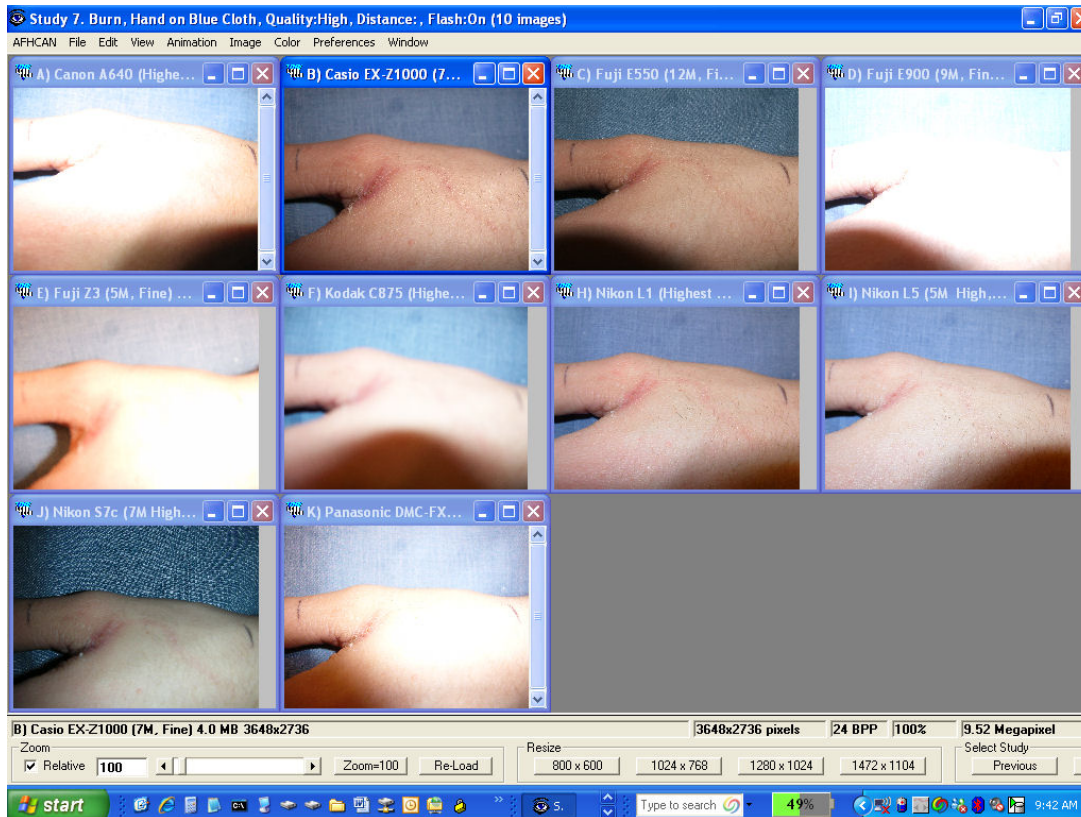




Analysis Tools

How do we compare images from many different digital cameras?

Measuring Color and Detail

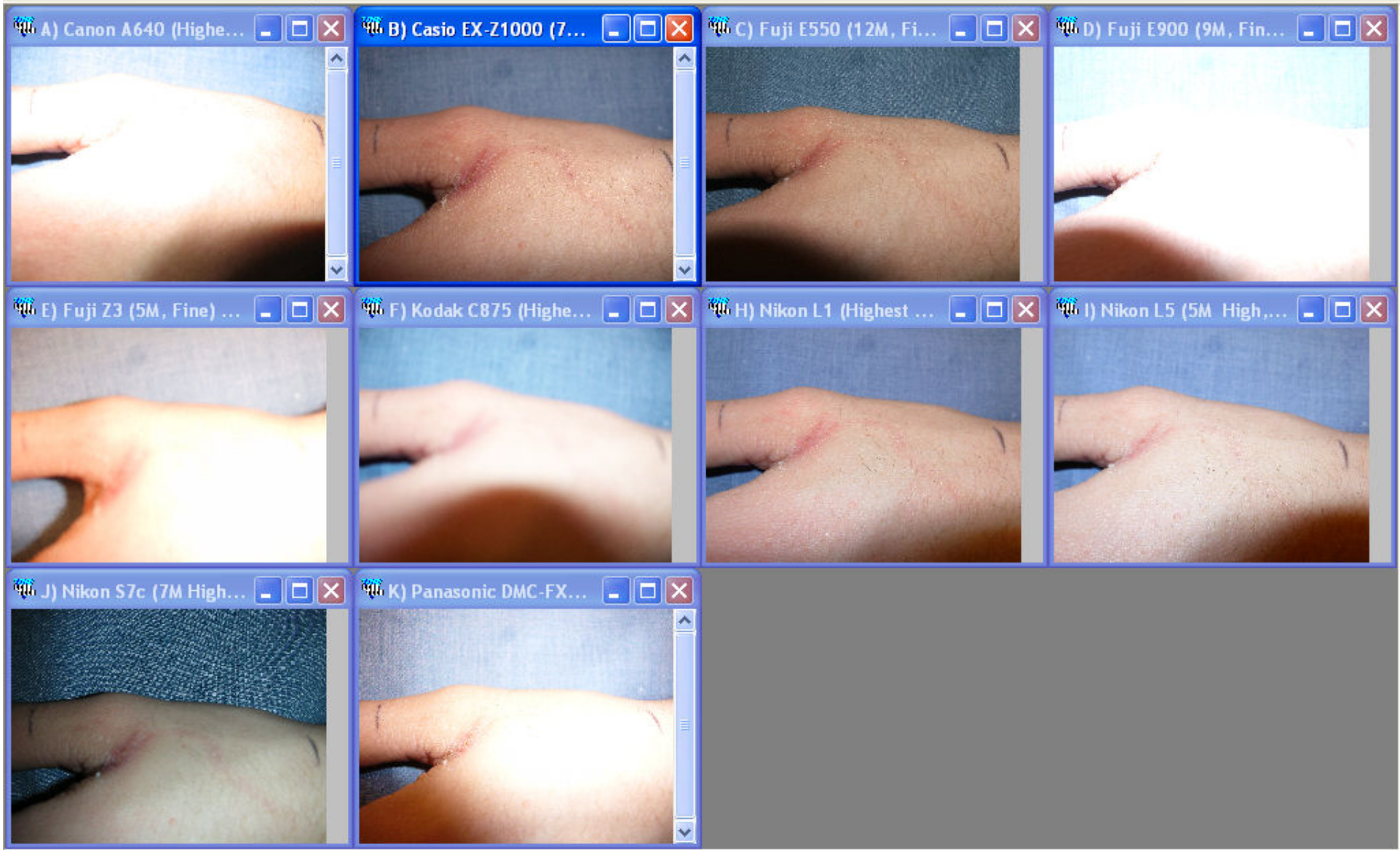


- ▶ Detail of an image is difficult to assess
- ▶ Need to compare images side by side
- ▶ Need to be able to zoom in



Study 7. Burn, Hand on Blue Cloth, Quality:High, Distance:, Flash:On (10 images)

AFHCAN File Edit View Animation Image Color Preferences Window



B) Casio EX-Z1000 (7M, Fine) 4.0 MB 3648x2736 3648x2736 pixels 24 BPP 100% 9.52 Megapixel

Zoom: Relative 100 [Slider] Zoom=100 Re-Load

Resize: 800 x 600 1024 x 768 1280 x 1024 1472 x 1104

Select Study: Previous

Study 7. Burn, Hand on Blue Cloth, Quality:High, Distance:, Flash:On (10 images)

AFHCAN File Edit View Animation Image Color Preferences Window



C) Fuji E550 (12M, Fine) 4.2 MB 4048x3040 4048x3040 pixels 24 BPP 100% 11.74 Megapixel

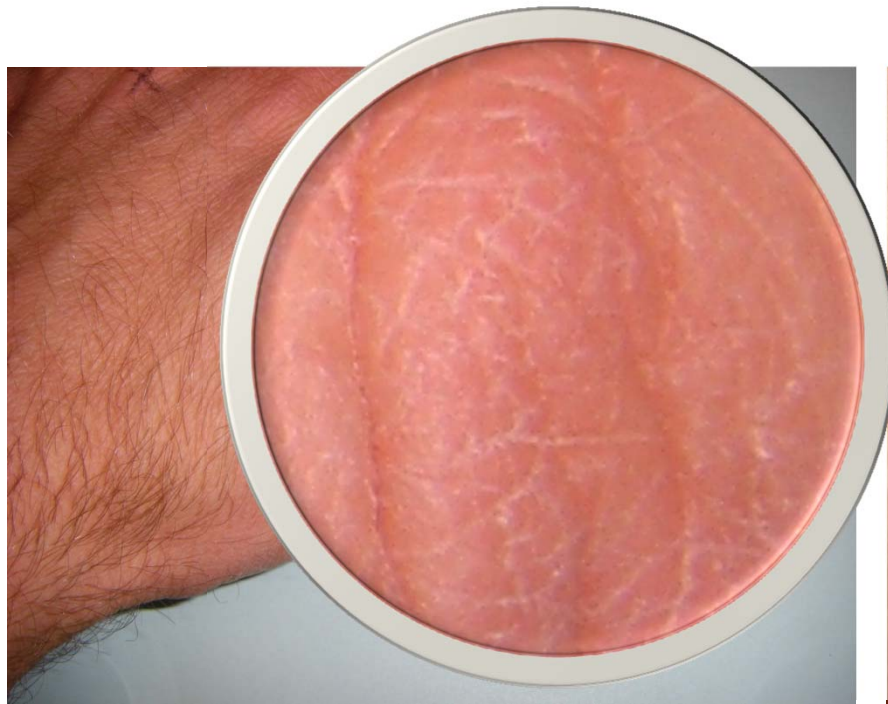
Zoom: Relative 400 Zoom=100 Re-Load

Resize: 800 x 600 1024 x 768 1280 x 1024 1472 x 1104

Select Study: Previous

Example of Detail Scoring

Hand, Flash: On, Distance: 10 in



Detail Score: 4

Detail Score: 2

Example of Color Scoring

Hand, Flash: On, Distance: 10 in



Color Score: 4



Color Score: 1

Color

HP927



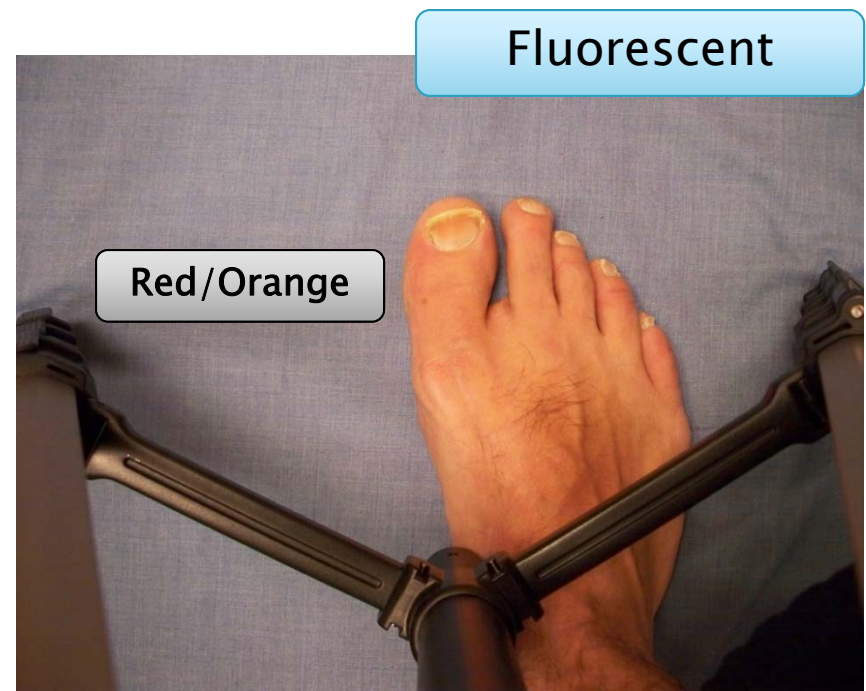
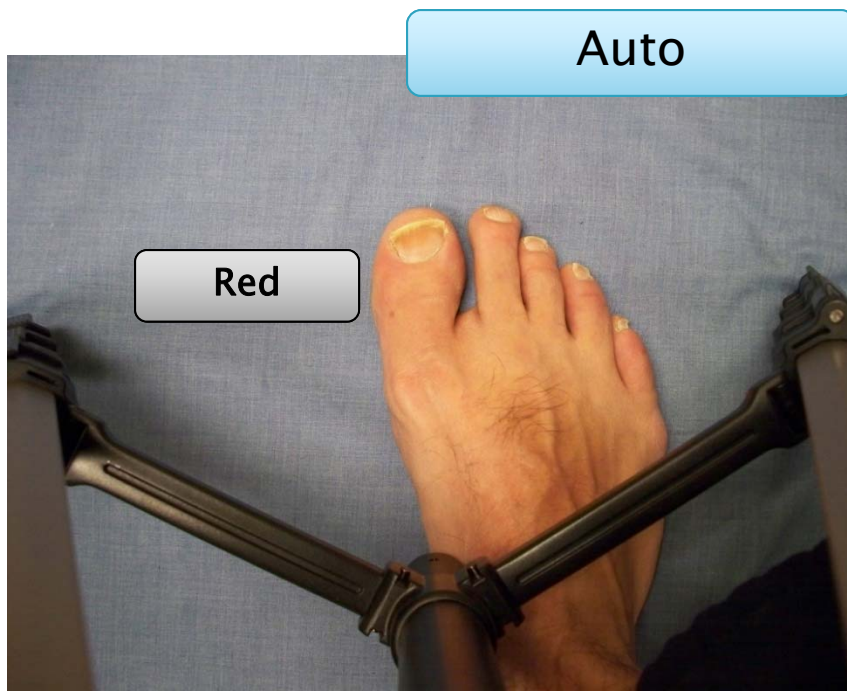
Flash Off
Cadaverish



Flash On
Redish



Kodak V1233 White Balance Settings



The Impact of Flash

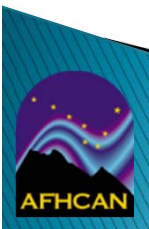
SonyDSCW200

FujiF40

FLASH OFF



FLASH ON



Impact of Flash

Kodak V1003

- Incandescent Lighting & Flash Off and On -



Kodak V1003 Leg Birthmark
Macro
Flash Off
Incandescent Lighting



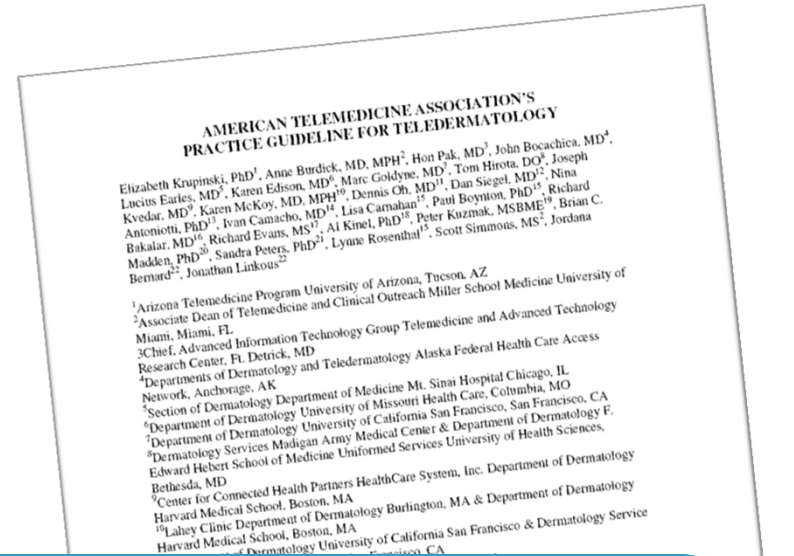
Kodak V1003 Leg Birthmark
Macro
Flash On
Incandescent Lighting



ATA Guidelines

III. Optional Steps Towards Optimizing Tele dermatology Practices

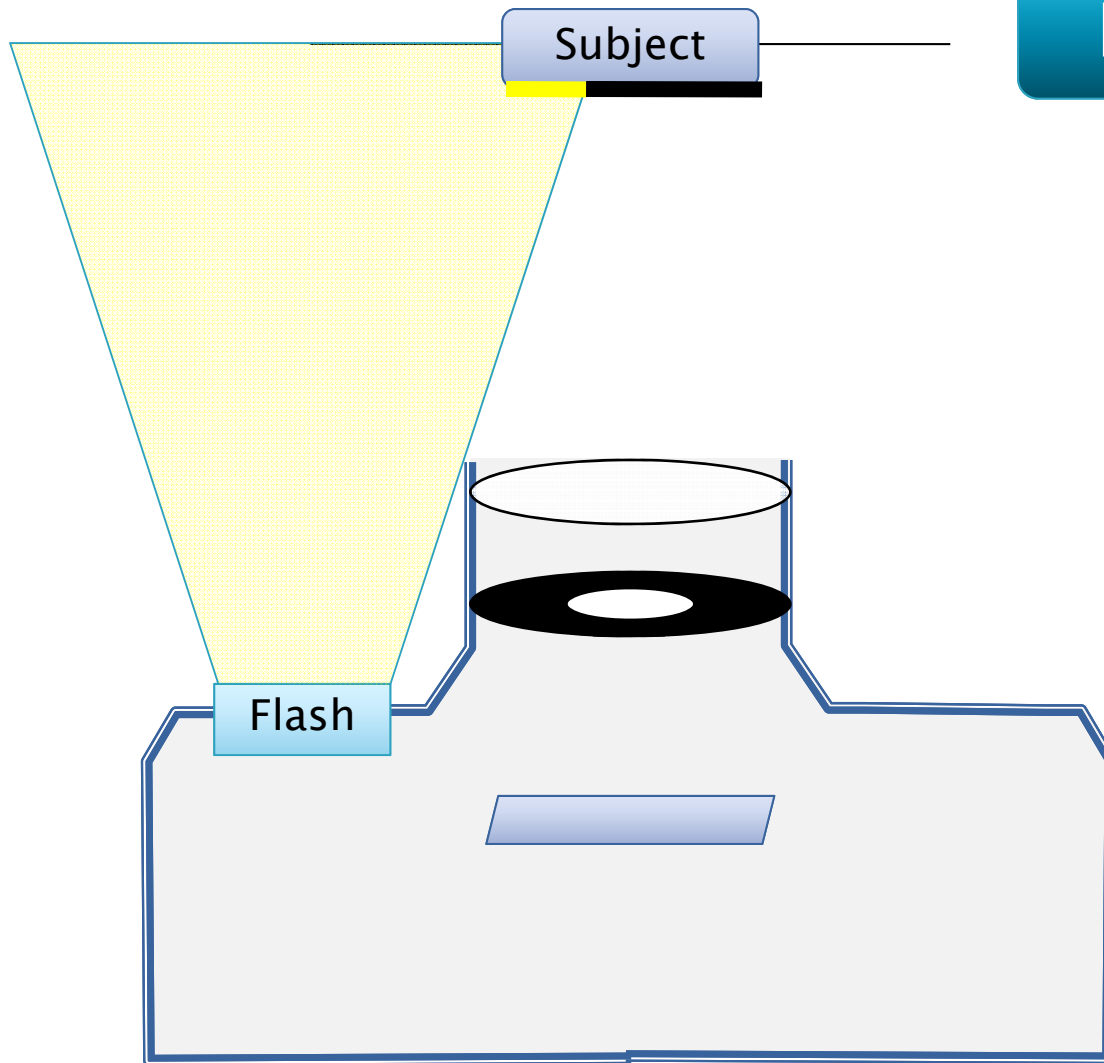
b. Technical Specifications



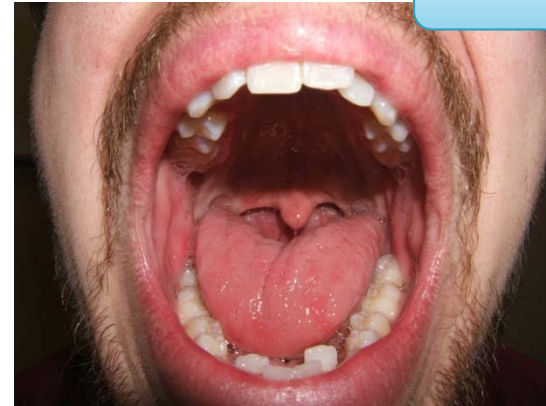
Flash: The digital camera *may* have flash capability. If it does, it is recommended that the flash output be adjusted to avoid washout of close-up images. **Do not use the flash if washout occurs.**



Flash Effects



Parallax



Overfill

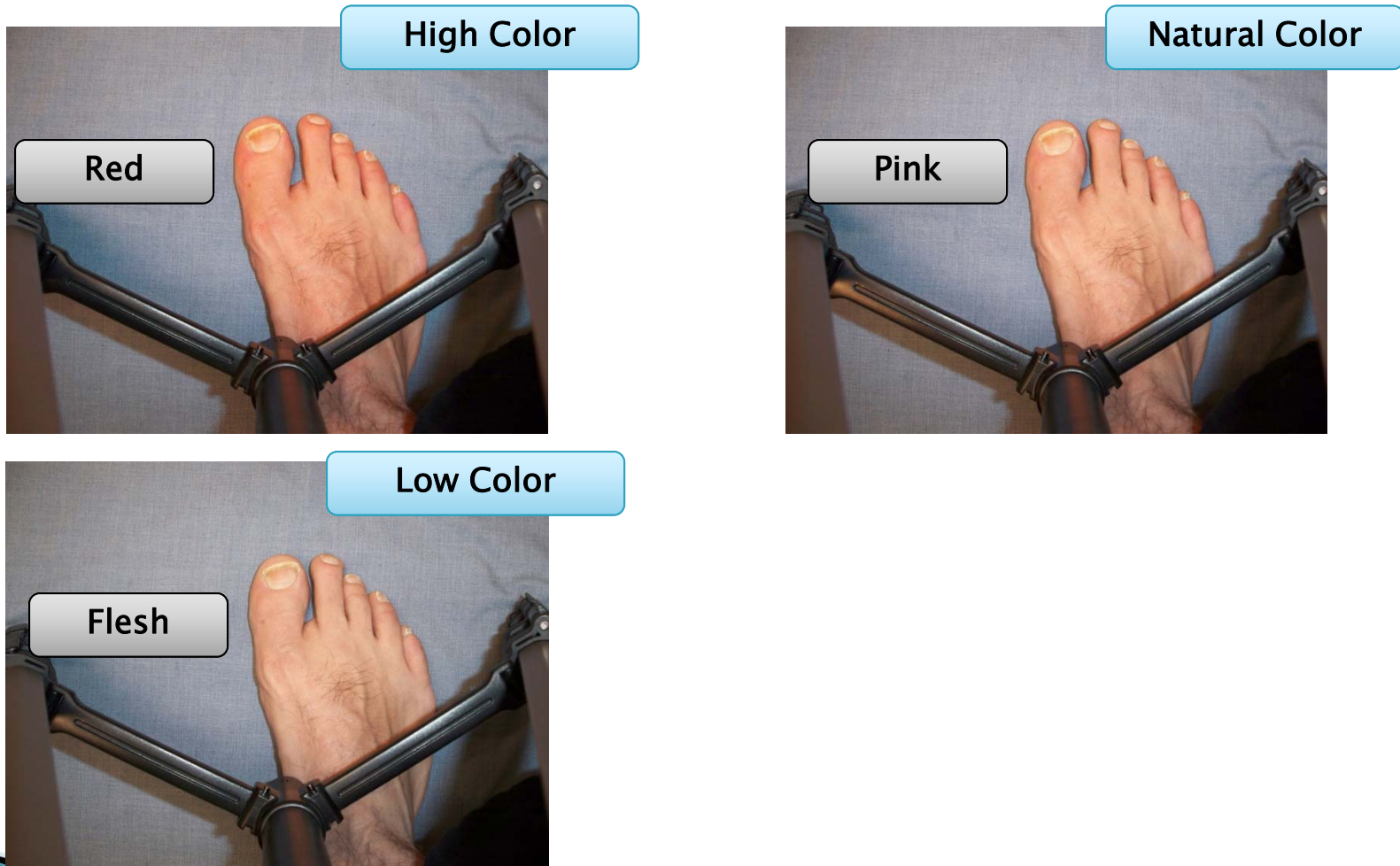


Hint: Adjust flash output

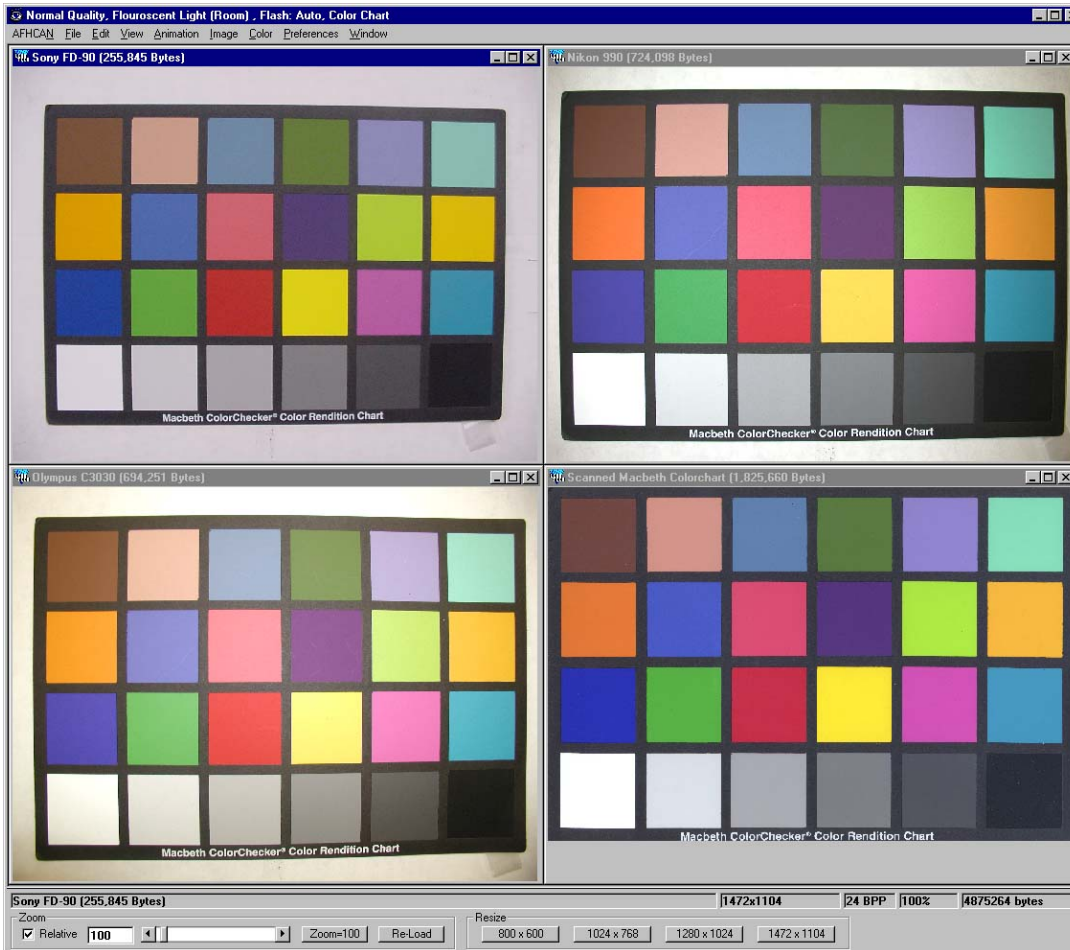


Impact of Color Settings

Kodak V1233 *Flash On*



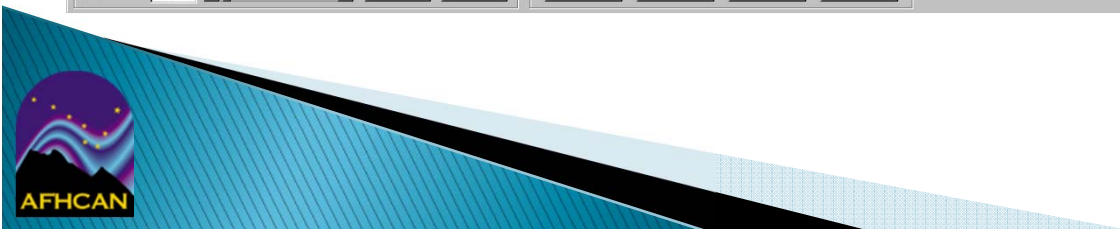
MacBeth Color Chart



Considered a “standard”
for color calibration

Good for estimating
color saturation

Limited usefulness in
determining if a camera
will provide accurate skin
tones



Measuring Color Accuracy

- ▶ Some cameras are better than others at color reproduction.
- ▶ A single camera will produce various color hues depending on the basic camera settings.
 - Needs to be tested with, for example, flash & macro
- ▶ ... and also depending on the advanced camera settings (e.g. Kodak color settings)
- ▶ Camera behavior may change under different lighting conditions
 - Fluorescent or incandescent or sunlight or ...



Image Detail: Compression

Casio Exilim



8 MP Fine Mode
(4 MB)

8 MP Economy Mode
(1 MB)

Compression Settings Have
Minimal Impact on Image Detail

Image Detail: Pixel Count

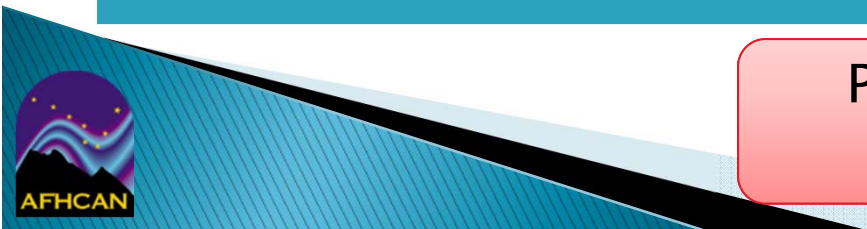
Hand, Flash: On, Distance: 10 in



12 Megapixels

1.2 Megapixels

Pixel Settings Have a Large Impact on Image Detail



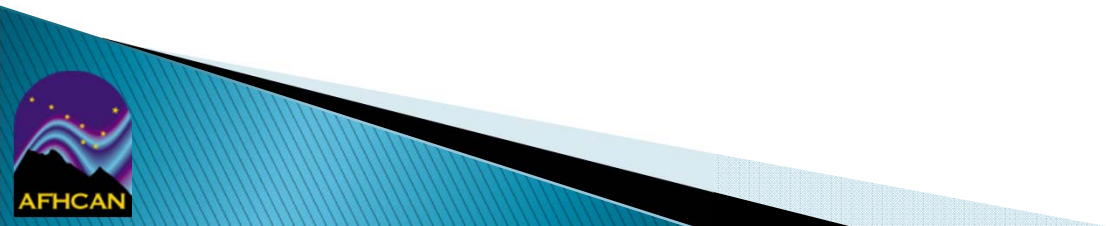


Features and Ease-of-Use

Why does taking a picture feel seem as complicated as landing a passenger jet?

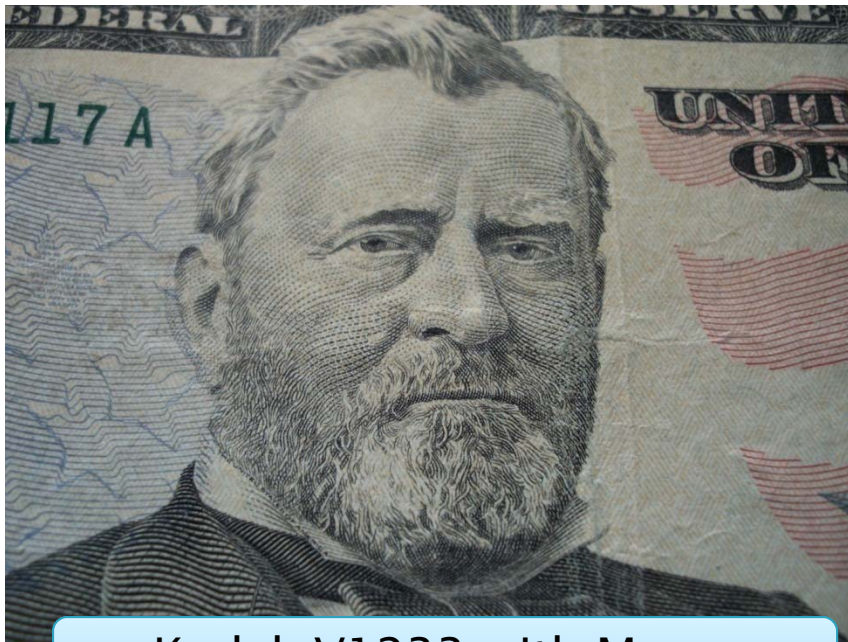
Ease of Use

- ▶ **Can the end-user understand the controls sufficient to take good pictures?**
 - e.g. What are the training requirements?
 - e.g. Can it easily take high quality macro images?
- ▶ **Topics to consider:**
 - Macro Mode
 - Flash
 - Size
 - Batteries and Power Charging
 - Image Transfer



Why Macro?

... allows for closest approach to subject



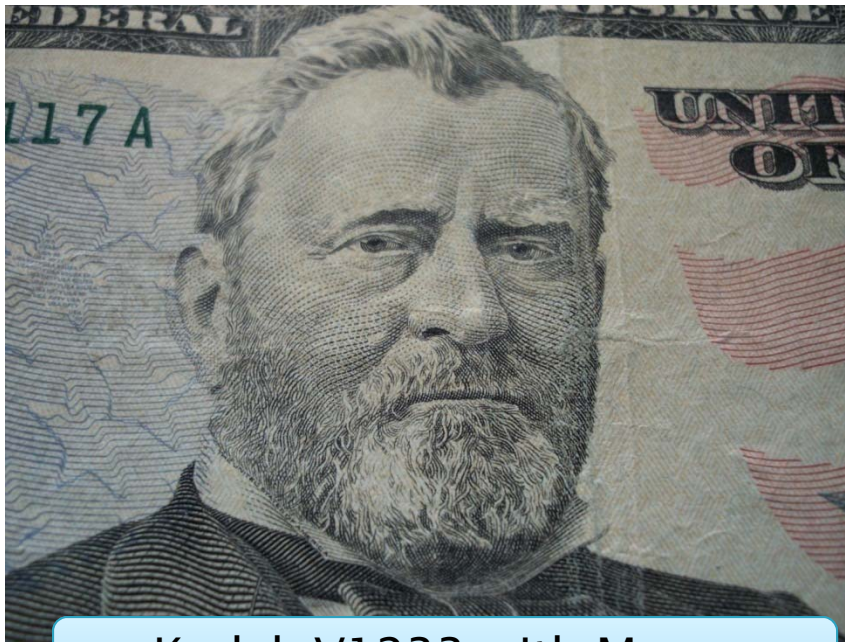
Kodak V1233 with Macro



Kodak V1233 without Macro

Why Macro?

... allows for closest approach to subject



Kodak V1233 with Macro



Kodak V1233 without Macro

Macro Access – Easy



Macro Button (On/Off)

Sony Mavica FD90
Kodak Z885

Macro Toggle (On/Off)

Sony DSC-W200
Nikon Coolpix 3100
Canon A640
Fuji E E550, E900



Macro Access – Most Difficult



Macro Button with ½ zoom
Nikon Coolpix 990



Press Menu Button, then choose Shooting Mode, then chose Close Up
HP Photosmart 747



Testing Macro Ease of Use

Ask an innocent bystander to put the camera into “macro” mode.

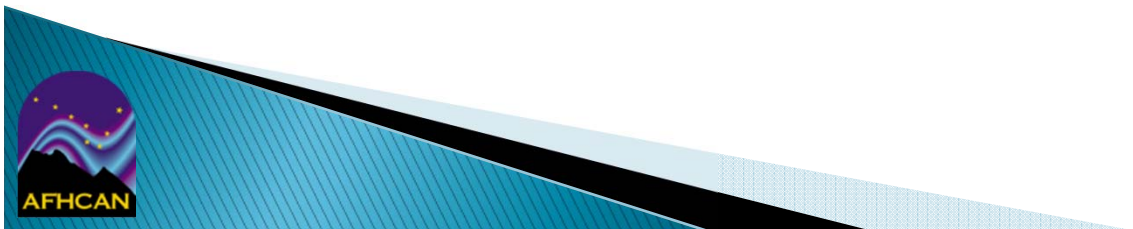


Great Idea! This is not just for macro ...

Trends for 2010

- - Auto Macro - -

	Canon SD3500	Casio FH100	Fuji F80EXR	Kodak M580	Nikon S8000	Olympus 7040	Panasonic DMC-ZS5	Pentax H90	Samsung HZ35W
Auto Macro	Yes	Yes, But	Yes	Yes	Yes, But	Yes	Yes	Yes	Yes



Batteries: Power to the System

- ▶ Rechargeable vs Disposable
- ▶ Standard vs Proprietary Form Factor (Shape)
- ▶ Battery Technology
 - e.g. Alkaline, LiMH, NiCad, NiMH, ...
- ▶ Charger Options
 - Docking Station
 - USB Cable
 - AC Adapter
 - External Charger
- ▶ Don't ignore Power Consumption



*Examples of AA Batteries
Ni-MH Battery Pack, Ni-MH,
and Alkaline*



*Examples of
Lithium Ion
Batteries for
Casio, Kodak and
Sony Cameras*

Docking Station (Camera Cradle)

▶ ADVANTAGES

- Batteries always charged
- Images easily moved
- Camera in known location
- No battery charger or USB transfer cable to lose

▶ DISADVANTAGES

- Additional cost
- Mounting and cable management
- Confusion: Which direction to place camera? Potential for damage?
- Limits choice of camera
- Difficult to find info



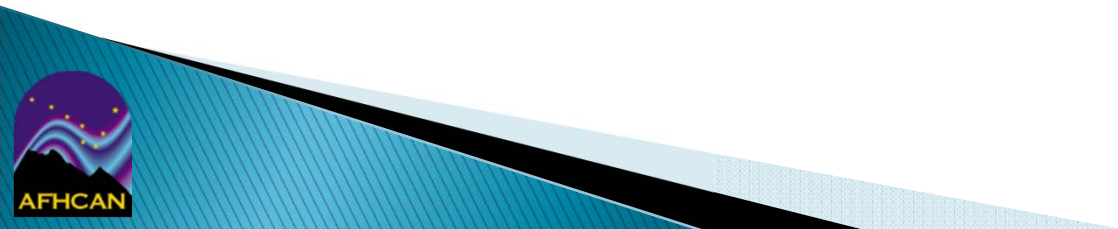
Camera and docking stations for Kodak V1233, Sony DSC-W200 and Casio EX-V8

Lessons Learned



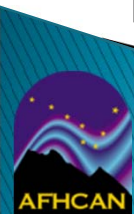
Lessons Learned – Testing

- ▶ Have all cameras ready prior to shooting photos.
- ▶ Shoot photos consecutively with cameras to capture same person at same day under same conditions.
- ▶ Subjects are not always available other than your one opportunity.
- ▶ Set up a table/spreadsheet of which photos you will shoot with each camera.
- ▶ It is reasonable as a first run to shoot @ 25 photographs with each camera.
- ▶ Some cameras have different settings, so the spreadsheet will change, i.e. “soft flash”
- ▶ If you return or borrow a camera, you may need it later for a new photograph.
- ▶ Comparing images by file size is helpful.

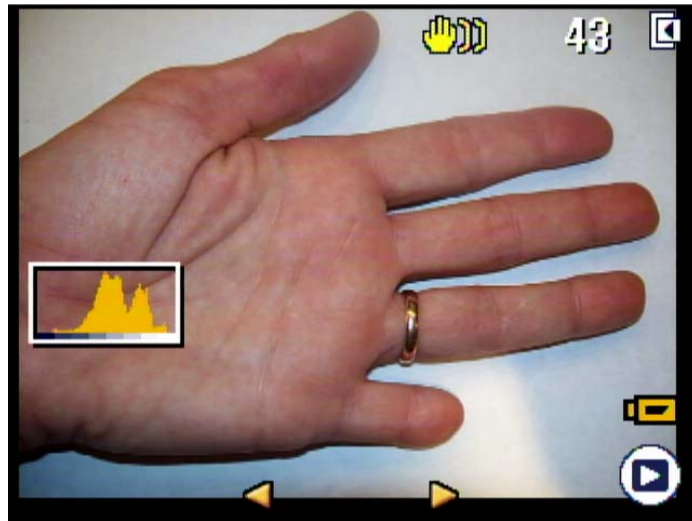


Lessons Learned – General

- ▶ There is NO substitute for testing in real world clinical conditions.
- ▶ Consumer-grade devices need appropriate settings for Telehealth
- ▶ Technology Review process can often reveal the “optimal” settings for a specific model or manufacturer.
- ▶ Color accuracy is often the distinguishing characteristic between cameras.
- ▶ Reliability is difficult to predict for devices with shelf lives of 3–6 months
 - Develop relationship with vendor – extended warranty.
 - Search the web for complaints
- ▶ Talk with your local camera store.
- ▶ Rapidly changing technology, e.g. digital cameras, may require revisiting the market evaluation multiple times



Digital Cameras – They’re Not Just for S&F Anymore !



The video output of a digital camera can be coupled to the secondary camera input on a videoconferencing system.

Megapixel images can be captured and zoomed to show high levels of detail.

Conclusion?

- ▶ **Digital cameras are constantly changing**
 - Last year's winner is sometimes this year's dud
 - Plan on regular reviews – cameras are frequently discontinued
- ▶ **Important to know the user and need**
 - Need drives the activity; focuses the assessment
- ▶ **Technology assessment is a skill**
 - Building upon previous experience is useful
 - Keep great records
 - Use consistent tools
 - Share your results and experiences!

