Measuring Color Accuracy of Wound Photographs

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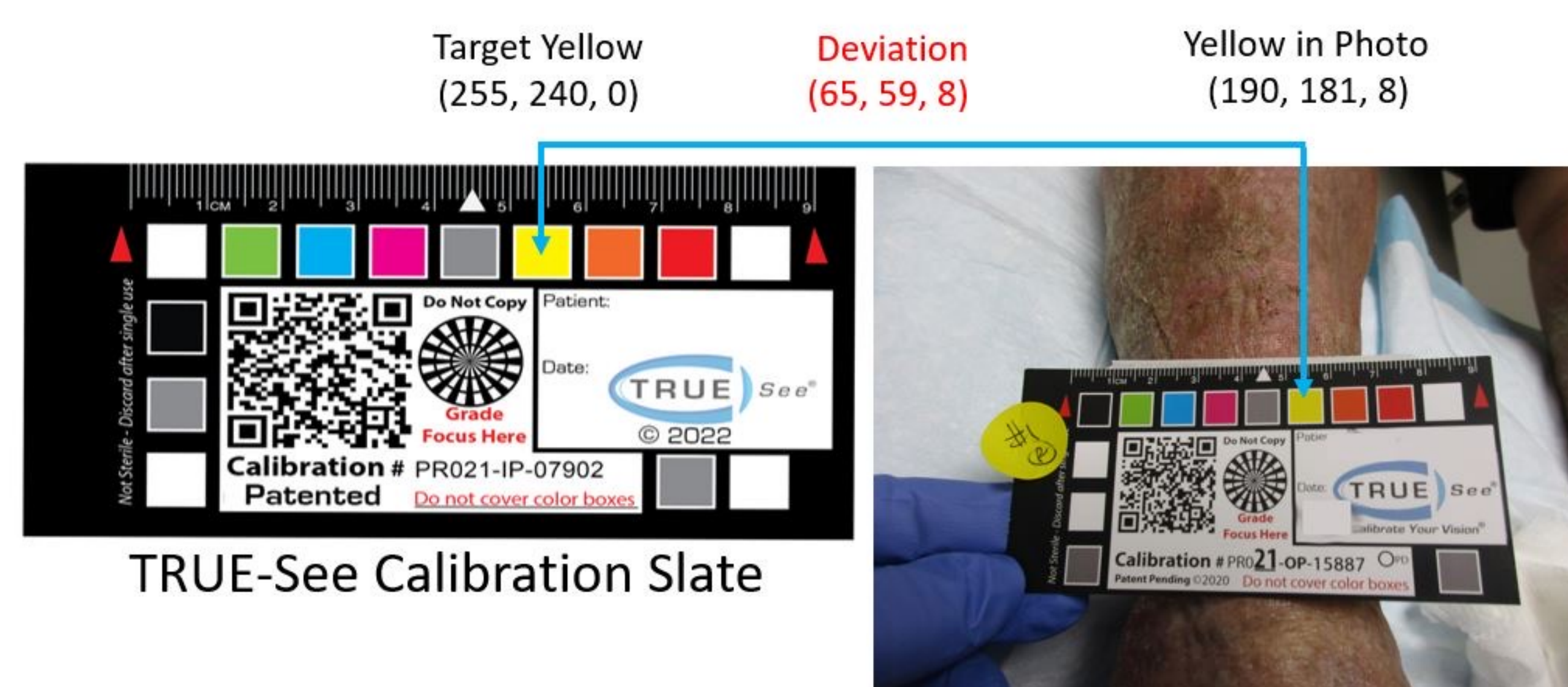
Introduction

- Medical photos are used in the assessment and documentation and treatment of wounds.[1,2]
- Inconsistencies in technique and technical variability of photographic devices cause substantial color errors that misrepresent clinical observation,[2,3,4] decrease quality of documentation,[1] cause delays in diagnosis,[5,6] and improper conclusions.[3,7]

Objective

- This research measures the color accuracy of wound photos from a database of 50,900 photos taken at 14 facilities (inpatient and outpatient) in the US between 12/1/21 – 12/15/23.

Methods

- A color chart with a tracking number was placed into the photo field. Studies have shown that a color chart in the photo can be used to measure color accuracy.[3] The color chart contains known target colors that are measured using the Red, Green and Blue (RGB) color system.

Target Yellow (255, 240, 0)   Deviation (65, 59, 8)   Yellow in Photo (190, 181, 8)
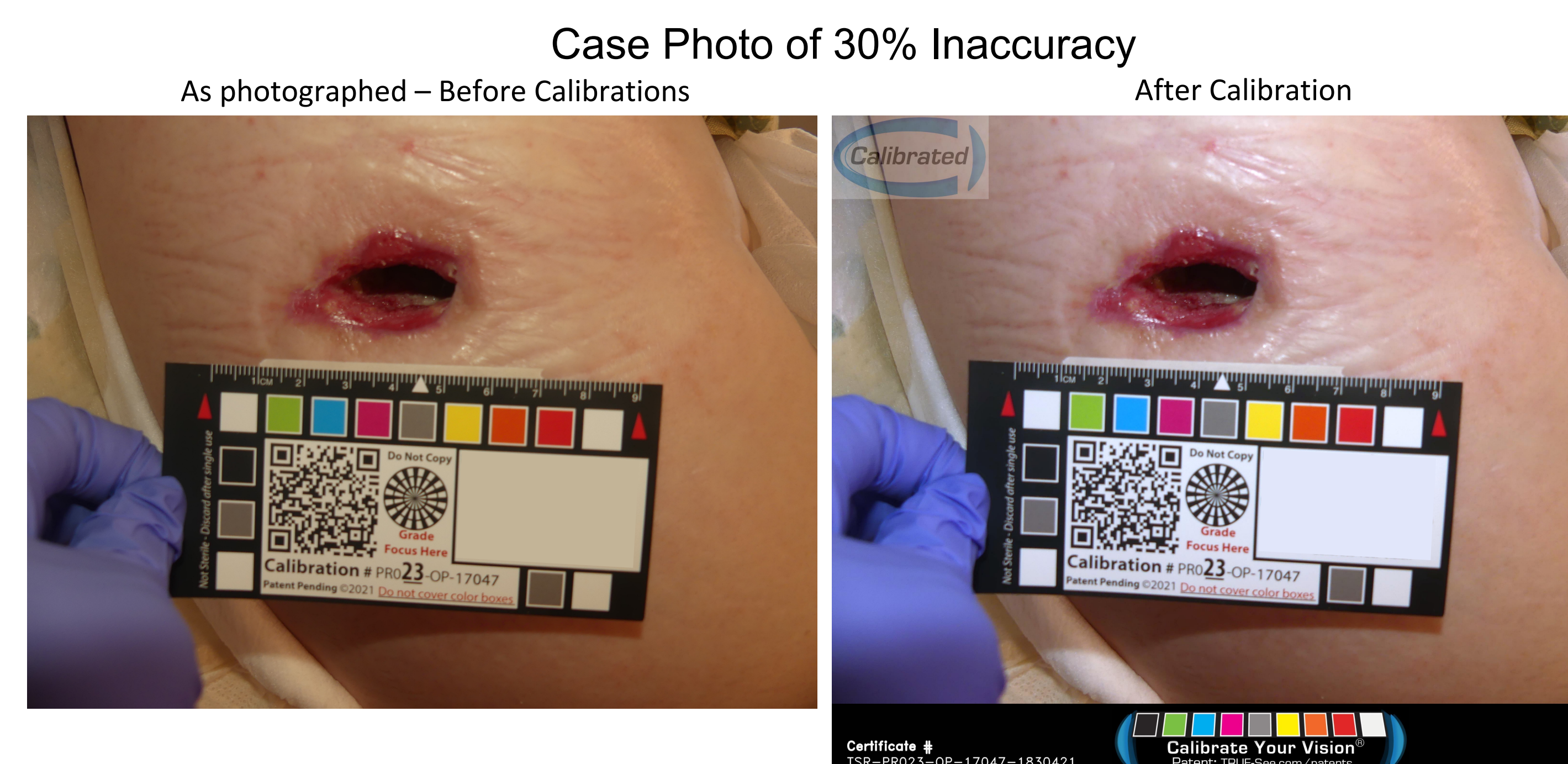
TRUE-See Calibration Slate

- Color calibration software was used to detect the color chart and calculate the difference between the target RGB value and the RGB color chart detected in the photo. The percent color change was calculated for each photo and reported at 10% color difference increments from 0% to 100% and >100%.
- The database was searched for the clinically relevant colors, Black, Yellow, and Red, on the Wound Healing Continuum.[8]
- Researchers have proposed that accuracy and precision within 10% as sufficient for measurement of wounds.[10]

Results

Frequency and Degree of Color Accuracy
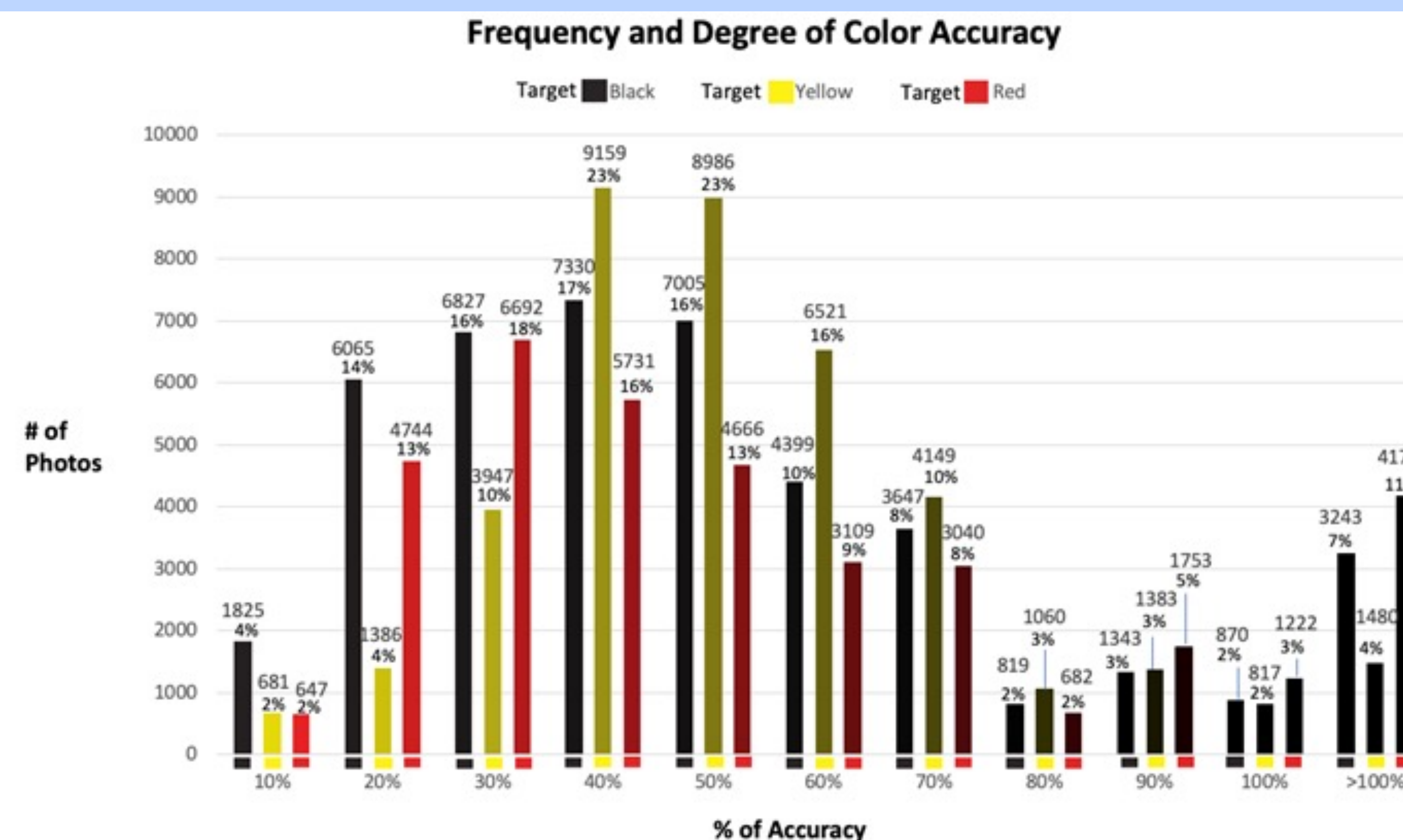
- Only four photos were consistent with the target RGB for Black, zero for Yellow and Red.
- Significant color inaccuracy was found in the photos: 4.23% of Black, 1.66% of Yellow and 2.02% of Red photos met the 10% accuracy threshold.
- 62.29% of the photos were 50% off from the target values.
- The following photos demonstrate the visual difference at 30 and 40% color deviation.

Case Photo of 30% Inaccuracy

As photographed – Before Calibrations   After Calibration

Case Photo of 40% Inaccuracy

As photographed – Before Calibrations   After Calibration

Conclusions

- The color chart and calibration methods used identified significant color inaccuracy.
- Color inaccuracy makes precise, verifiable color calibration necessary for photos to properly represent the live observed wound.[4]
- Photo acquisition is the most critical step of medical photography, as errors will be propagated through process and into the medical record.[3]
- This research is critical to defining the clinically relevant discernible differences in photo colors, so photos are a true and accurate representation of clinical observation.

Future Studies

- The study can be repeated with additional colors on the slate, different wound types, and skin colors to identify which are most problematic for clinicians and have the greatest risk of misinterpretation and or diagnostic error.
- Additional models of analysis such as three dimentional plotting of colors and CIEDE2000 Color Deviation will help measure the color differences and develop a color correctness or confidence score of the photos.
- Inter-rater reliability studies can then be used to validate the data.

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