## Comparison of Skin Color Measurements between Digital Imaging and Colorimeter Beijing Technology and Business University <sup>1</sup>, Tokyo University of Technology <sup>2</sup> °Wu Yue<sup>1</sup>, Makio Akimoto<sup>2</sup>, Kazuhisa Maeda<sup>2</sup>, Dong Yin-mao<sup>1</sup> E-mail: buetsu95@gmail.com

**Background and Objective:** Skin color status has a major impact on dermatology and cosmetics. It's essential to develop a kind of more objective measurement method of skin color.

**Materials and Methods:** The paper compares the difference between digital imaging by re-Beau instrument (JMEC, Tokyo) and colorimeter by CR-13 instrument (Konica Minolta, Tokyo) through testing 91 volunteers aged between 18 to 60 years old with three sites including forehead left cheek and jaw. Since CIE-L\*a\*b\* is widely used for evaluating skin color, the RGB values of the captured face image are converted to tristimulus value XYZ and then L\*a\*b\* is calculated. In CR-13's instrument, L\*a\*b\* values are displayed directly. Erythema is evaluated using the a\* parameter. Pigmentation is evaluated by the values of L\*, b\* or combinations of the them. Caluculated parameter based on the L\*a\*b\* system is the individual typology angle (ITA) and hue angle (h<sub>ab</sub>). There are defined as the vector direction in the L\*-b\* or a\*-b\* plane: ITA={tan<sup>-1</sup>(L\*-50)/b\*} × 180/\pi, h<sub>ab</sub>=tan<sup>-1</sup>(b\*/a\*). According to ITA values, skin color can be classified into the following categories: Very light(I)>55 °, Light(II) 55 °~41 °, Intermidiate(III) 41 °~28 °, Tan(IV) 28 °~10 °, Brown(V) 10 °~-30 °, Dark(VI) <-30 °.

**Results:** The results are expressed in Fig.1. There are significant differences in different instruments. The ITA data is more dispersed in re-Beau instrument compared to CR-13 instrument, while hue angle data of CR-13 is higher than re-Beau. According to re-Beau data, there's significant difference in cheek of people before 30 years old and after 30 years old. ITA grade of cheek focus on III/IV/V in people aged over 30 years old. However it focuses on II/III/IV in people aged before 30 years old. This parameter has been validated as an expression of skin pigmentation by analysis of measurements.



Fig.1 Distribution of skin color (a) ~ (d) ITA; (e) hue angle (n=91).

**Conclusion:** We believe digital imaging data is more accurate and objective than colorimeter, because backscattered red light is more likely to escape the aperture of the colorimeter due to a greater mean distance between scattering events in colorimeter.