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Effects of Light Intensity and Color from Softbox Light Sources on 3D Facial Measurements Using a Structured-Light 3D Facial Scanner

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Abstract

Objectives: This study evaluated the effects of light intensity and color on facial dimensions measured along three axes (X, Y, and Z) using a structured-light 3D facial scanner.

Methods: Forty-seven adults (mean age 25.7±3.4 years) underwent facial scanning under two light intensities (500 and 700 lux) and two light colors (daylight and cool white) generated from a softbox photography lighting setup. The scans were performed in a room illuminated with ambient daylight-color LED at 300 lux without external light interference. Facial measurements were analyzed using Dolphin Imaging Software. Two-way repeated measures ANOVA was used to assess the effects of light intensity, light color, and their interactions on facial measurements. Statistical significance was set at $p<0.05$.

Results: Light intensity had no significant effect on 3D facial measurements ($p>0.05$). However, light color significantly influenced upper lip anterior-true vertical line through the alar base (ULA-TVL) and lower lip anterior-true vertical line through the alar base (LLA-TVL) measurements along the Z axis ($p<0.05$), with greater values recorded under daylight compared to cool white. No significant interaction effect between light intensity and light color was observed ($p>0.05$).

Conclusions: Light color influences upper and lower lip protrusion measurements in 3D facial scanning with a structured-light 3D facial scanner, whereas light intensity does not. Standardizing light color is recommended for consistent measurements.

Keywords: face, lighting, photography, 3D imaging