

Three-Dimensional (3D) surface-imaging to assess volume in the periorbital region: A control study

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Aim: The VECTRA M3 has been validated as accurate, repeatable and reproducible for measuring volume within a 0.4-5.5mL range. Our aim was to assess the mean difference in periorbital surface volume between two 3D images of healthy subjects taken at different time points to identify a measure of error magnitude. This is the first study to evaluate this technology for volume assessment in this region.

Material & Methods: Two 3D images were taken of 15 volunteers, more than 5 minutes apart, with eyes open and closed. Each pair of images for comparison were registered using either facial landmarks or by surface area. The volume change was then measured for the upper lid (supraorbital rim), the lower lid (infraorbital rim), the lower lid (extended to include tear trough and palpebromalar groove) and both lids together, resulting in 600 measurements. We assumed an accurate result to be no volume change.

Results: Mean change in volume was most accurate using surface area registration (0.10ml) compared with landmark registration (0.38ml; $p < .001$), and with eyes closed (mean [range], 0.09 [0.0005-0.52]mL) compared to eyes open (mean [range], 0.11 [0.0006-0.49]mL; $p = .04$). This was improved by measuring the lids separately rather than together, particularly the lower lid (mean [range] 0.06 [0.009-0.198]ml; $p = .01$). No significant difference extending measurement to the palpebromalar groove ($p = .05$).

Conclusion: Optimal measurements of periorbital surface volume were accurate with an overall mean absolute difference of 0.09ml. A methodology for measurement is proposed. This data is important to support further oculoplastic research to assess the use of 3D surface imaging for diagnosis, treatment monitoring, and surgical outcome evaluation.