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Evaluation of globe position within the orbit: clinical and imaging correlations

Significant variations have been reported concerning the size of the orbit and eyeball, and the position of the latter in the former.¹ Hertel exophthalmometry has inherent deficiencies, including the fact that the lateral orbital rim (on which it relies as a reference point) varies among individuals.² Previous studies have evaluated the position of the globe within the orbit and its correlations with MRI.³ We have also used a 1.5 T MRI scanner in a series of 32 adult patients (19 males, 59.3%) aged 56.22 (SD 13.80) (36 to 80) years, without any previous history of orbital surgery, inflammation of trauma, to measure the volumes of ocular and orbital structures and the distance of the eyeball poles from respective orbital landmarks. We aimed to examine whether intraorbital globe position is affected by orbital or eyeball volume. Images were analysed with the eFilm workstation (eFilm Medical, Toronto). The volumes of the orbit, eyeball and extraocular muscles were measured in T1 weighted coronal and sagittal images, as described elsewhere⁴ (fig 1). The eyeball volume was subtracted from the orbital cavity volume and the difference recorded as effective orbital volume (EOV), to provide an estimation of the available space in the orbital cavity to accommodate the eyeball. The minimal distance between the superior, inferior, medial, lateral and posterior eyeball poles and respective orbital landmarks was measured in T-1 weighted coronal and sagittal images through the globe equator. The intercanthal distance was measured

along an axis connecting the bony rims of the outer canthi (intercanthal line), whereas the anterior-posterior projection of the globe was evaluated by measuring the vertical distance between the intercanthal line and corneal apex (fig 2). The interglobal distance was evaluated by measuring the distance between the right and left axes vertical to the intercanthal line and passing through the corneal apex (fig 2). The power of the study, evaluated by G*power (version 3.0 10, Universitat Kiel, Germany) was 0.53 for the Pearson bivariate correlation coefficient given an effect size (r) of 0.3 and α -error of 0.05. EOVS was significantly correlated with the orbital volume (Pearson bivariate correlation coefficient 0.65, p = 0.02), with the intercanthal and interglobal distances (Pearson bivariate correlation coefficient 0.68 and 0.63, p = 0.01 and p = 0.04, respectively) and with the distance between the medial eyeball pole and medial orbital wall (Pearson bivariate correlation coefficient 0.63, p = 0.02) whereas it was inversely correlated with anterior-posterior globe projection (Pearson bivariate correlation coefficient -0.78, p = 0.01). These results agree with previous reports on the linear relation between volume introduction in the orbit and globe protrusion (Hertel curve)⁵ and imply that EOVS may be used in planning procedures to correct exophthalmos or enophthalmos, such as orbital decompression, orbital fracture repair or in the selection of orbital implant size following enucleation. Nevertheless, the small number of patients recruited in this study implies that the value of this parameter should be further evaluated with larger prospective studies. Although CT provides better bone imaging than MRI, the facts that both soft tissue (eyeball) and osseous margins (bony orbit) were included in the analyses and

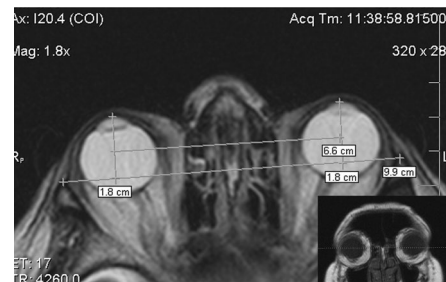


Figure 2 Intercanthal and interglobal distances as well as right and left globe projection (from a line connecting the lateral orbital rims) in a T-2 weighted transverse image through globe equator, as shown in corresponding coronal section (inlet).

that MRI is devoid of radiation hazards imply that the latter is an adequate tool for orbital volumetric calculations presented. Furthermore, the widespread availability and ease of use of MRI scanners imply that imaging parameters, such as EOVS which is also easy to calculate, may be more commonly used in clinical decision-making concerning orbital volume changes.

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Competing interests: None.

Ethics approval: Ethics approval was provided by Institutional Review Board, University Hospital of Heraklion, Crete, Greece.

Accepted 8 April 2009

Br J Ophthalmol 2009;000:000.
doi:10.1136/bjo.2008.150532

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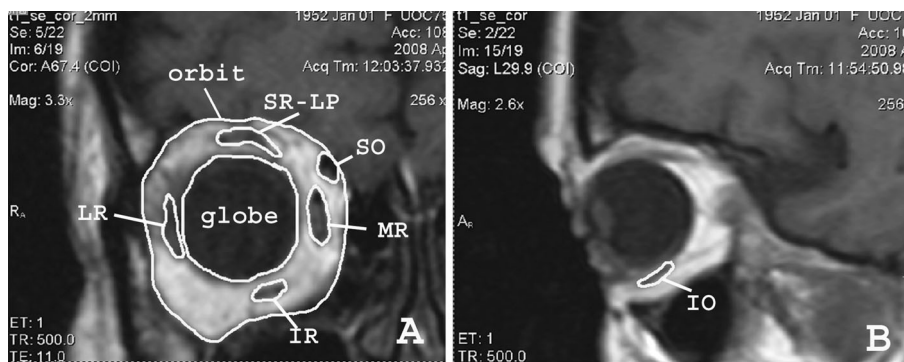


Figure 1 Delineated orbit, globe, IR, SR-LP, LR, MR and SO in a T-1 weighted coronal image (A) and delineated IO in a T-1 weighted sagittal image (B).