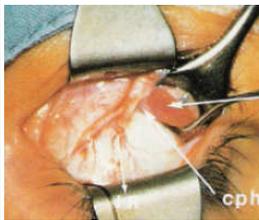


Anatomy



- Nasal to the IR crossing, IO is engulfed in orbital fat, is oval in shape with a diameter of 4-6mm.
- Lateral to the crossing it flattens and widens to 8-10mm and is covered by Tenon's capsule.

Anatomy

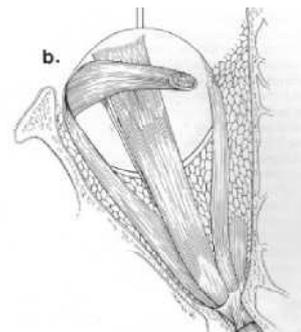
- Between the Tenon's capsule penetration and insertion, IO muscle capsule contributes to the intermuscular septum, which provides interconnection between IR, LR and IO.

Anatomy



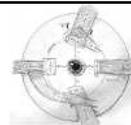
- The inferotemporal vortex vein exits from the sclera at the temporal border of IR, 12mm posterior to its insertion, then continues on a circuitous upward course on the inner surface of Tenon's capsule just posterior to IO before penetrating the muscle cone. Unless visualised at the time IO is hooked, the vein may be damaged.

Anatomy



- IO inclined posterolaterally at $\sim 45^\circ$ with AP plane, almost parallel with SO tendon
- The nerve and blood supply enter the IO in the undersurface of the "dogleg" turn, 15mm from the insertion, just lateral to IR.

Actions



- IO elevates the visual axis because it depresses the posterior aspect of the globe.
- Primary action, elevation, increases in adduction, and is nil in abduction. It is the only elevator in adduction.
- Subsidiary actions, abduction and extorsion, increase with abduction and decrease with adduction.

Anatomical Variations

- Stephen Kraft, Toronto, 1999, Am J Oph
- 100 cadaver "virgin" orbits:
 - # of divisions at insertion
 - Variation in anatomy 10 and 12mm from insertion
 - Total width of muscle belly

Anatomical Variations - Kraft

- 17 multiple insertions, ranging from 2 to 4
- 8 had divisions at surgical capture site. Among these 8:
 - 4 had dehiscences within the muscle that resulted in 2 distinct bellies at 10 and 12mm positions, but the bellies rejoined at the insertion.
 - remaining 4 had bifid muscle bellies that inserted separately into the sclera.

Anatomical Variations - Kraft

- Muscle width at 10mm:
 - 8.4mm in 8 double bellies vs 7.7 in 92 other (not stat sig)
- Muscle width at 12mm:
 - 7.8mm vs 7.3 (not stat sig)

Anatomical Variations - Kraft

- These results are for "normal" patients
- The incidence of anatomical variations could be higher in those with IOOA - ? Double bellies have greater vertical action
- Failure to detect duplications at time of surgery → incomplete weakening and recurrence/persistence.

Anatomical Variations – Kraft 2

- JAAPOS 2001 – prospective survey over 7 years.
- Compared eyes with double vs single bellied IO muscles:
 - Grading of pre-op IO & SO actions
 - Presence of fundus exocyclotropia
 - A/V patterns
 - Presence and size of primary position hypertropias
 - Post-op IO action

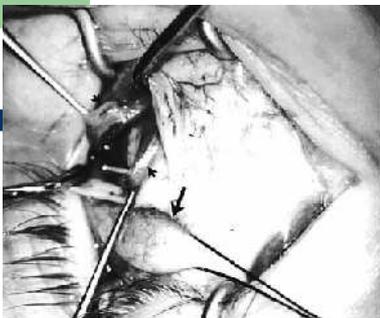


FIGURE. Surgeon's view of double-bellied inferior oblique muscle in a left eye. A silk suture around the lateral rectus muscle (page arrow) is retracting the globe upward and medially. Tenotomy hooks are lifting and pulling apart a smaller anterior belly and a larger posterior belly (small arrows). Note intact glistening muscle sheaths around each belly.

Anatomical Variations – Kraft 2

- 27 of 247 (11%) eyes operated on had double bellied IO.
- Only fundus exocyclotropia incidence differed between groups – 48% with double bellies vs 27% with single bellies.
- The efficacy of weakening surgery in reducing IOOA was similar in both groups.

Anatomical Variations – Kraft 2

- Bottom-line:
 - About 10% of normals and IOOA have double bellied IO
 - If pt has fundus exocyclotorsion – look hard for 2 bellies, but if no fundus exc → doesn't rule out 2 bellies.
 - No pathognomonic signs that can predict 2 bellies.

Neuro(fibro)vascular bundle of IO

- David Stager, Texas, JAAPOS, 1997
- Cadaveric eyes and surgical specimens
- To investigate why IO anterior transposition often converts to IO to an "anti-elevator"



Neuro(fibro)vascular bundle of IO

- This study showed that the NFVB has a linear (not circuitous) course in the orbit.
- It is 27mm long and extends from the orbital apex to the midportion of IO just temporal to the lateral border of IR.
- The terminal 8mm of the nerve lies encased within surrounding fibrous tissue bands that attach posteriorly to IR muscle capsule and anteriorly to IO muscle capsule.
- These fibrous bands may represent a posterior modification of Lockwood's ligament into a check ligament that binds the 2 muscles.

Neuro(fibro)vascular bundle of IO

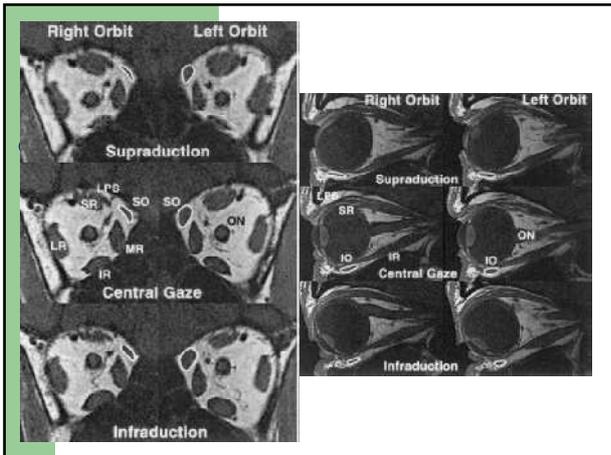
- This study also shows that the NFVB:
 - Has anatomical and physiological properties like a ligament (it is stiff).
 - Functions as an ancillary origin for IO

Imaging of IO

- Joseph Demer, Ophthalmology, 2003
- Aim: To study the size and contractility of the normal IO using high-res MRI and to evaluate abnormalities of SO and IO muscles in chronic SO palsy.
- Subjects: 13 pts with SO palsy, 17 orthotropic pts
- Methods: 2mm sagittal and coronal images repeated in multiple gaze directions.

Results

- MRI confirmed ipsilateral decrease in SO size and contractility in pts with chronic SO palsy.
- In all subjects, anterior movement and contractile thickening of IO was observed in supraduction, with posterior movement and relaxational thinning in infraduction.



Results

- But, in pts with chronic unilateral SO palsy, the IO cross-sectional area did not differ from either eye, nor from normal subjects.
- So despite these pts having IO “overaction”, their IO on MRI is not hypertrophied, nor exhibits supranormal contractility.
- “Overaction in adduction” due to a normal IO faced with a weak antagonist SO?