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Sir,
Repetitive stress injury and thyroid eye disease

Thyroid eye disease (TED) is an integral part of the clinical presentations of thyroid disease. The clinical manifestations of TED are due to inflammation, oedema, and fibrotic changes within the soft tissues of the orbit resulting in a variety of clinical manifestations.

Extra-ocular muscles (EOMs) involvement in TED is characterised inflammation and swelling of the EOMs. This will eventually lead to tightening of the some EOMs resulting in limitation of eye movements and diplopia.

The most common motility abnormality is limitation of elevation owing to fibrosis and tightness of the inferior rectus muscle. This followed by medial rectus, superior rectus, and the lateral rectus in that order.

A valid question is why the inferior recti are the most commonly involved muscles, followed by the medical recti, superior recti, and lateral recti in that order. There are two variables in this situation—the degree of involvement of a particular EOM involvement in the pathological process and its function. Given that all EOMs are more or less involved to a variable degree in the pathological process underlying TED, the second variable may explain why certain EOMs are more commonly involved by fibrosis than others. The most common gaze in humans, as upright creatures, used in the daily activities such as walking, eating, desk work, and so on, is looking downwards. The second most common gaze used is convergence looking at close objects followed by looking up and looking laterally in that order.

From the above, we may deduce that a frequently contracting/used muscle, which is involved by the pathological process of TED, is more likely to undergo fibrotic changes. Thus, thickened and inflamed muscle fibres may undergo fibrotic changes when used 'excessively'.[1] A pre-existing latent or manifest deviation that results in increased tone/contraction of a particular muscle(s) might also have an influence on which muscle involved by contracture, particularly, in the case of the lateral recti. Such injury could be classified as small repetitive stress injury (RSI) leading eventually to fibrotic changes. This RSI is analogue to what is seen in xantholasma of the upper eyelids and keloids at the tips of the elbows.

Xanthelasma is characterised by yellowish plaques deposits that occur commonly in the medical canthus areas of the upper and less commonly the lower eyelids. It mostly occurs in patients with hyperlipidemia. Perhaps the eyelid blinking, squeezing the eye, and frequent opening and closure of the eyelids, may result in leakage of the micro vessels and deposition of lipids and the inner corner of the eyelids, the area with the thin skin with less adherent tissue. Similarly, the blinking mechanism (along with frequent closing and opening of the eyelids), which results in frequent contraction of the levator muscle, may have a role in the tightening of the levator muscle in patients with TED resulting in lid retraction, a common feature in TED.

Another possible example of minor trauma and irritation in predisposed individuals may produce keloids. The trauma may be trivial, for example, pressure on the tips of the elbows can produce fibrotic changes resulting keloids in susceptible patients perhaps analogue to what is seen in the frequently contracting EOMs in TED.

Conflict of interest

The author declares no conflict of interest.

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Sir,
When is the best stage of training to sit the Fellowship of the Royal College of Ophthalmologists Examinations

The Royal College of Ophthalmologists (RCOphth) offers examination deadlines, therefore leaving when to best sit these examinations to trainees. The Fellowship

Part 1 must be obtained before entering the third year of ophthalmic specialist training (OST).[1] The Refraction Certificate must be obtained before OST4.[1] The Fellowship Part 2 Written and Oral examinations must be obtained before completion of OST.[1]

Obtaining the Part 1 before entering OST is considered during OST recruitment and therefore those attempting to enter OST are incentivised to sit the examination. Whilst in OST, examinations can prevent trainee progression; therefore, timing of sitting exams is a source of debate. Colloquially early sittings give a chance of failure and late sittings give a reduced time window to re-sit if necessary.

We have analysed RCOphth examination reports to study what stage candidates take examinations and are more likely to be successful.[2]

202 Part 1 candidates were successful from 426 (47.42%) attempts October 2012–May 2016 (when Foundation year 2 doctors were separated in statistics), with January 2015 unavailable; Figure 1a. Those who sat Part 1 in OST1 and OST2 were significantly more likely to pass than those in FY2 ($P = 0.01$, χ^2).

244 Refraction candidates were successful from 315 (77.46%) attempts December 2012–March 2016 (when the examination changed to the current format), with April 2013 unavailable; Figure 1b. There was no association between grade and pass rate ($P = 0.99$, χ^2).

380 Part 2 Written candidates were successful from 541 (74.71%) attempts February 2013–June 2016 (when the examination changed to the current format); Figure 2a. There was no significant association between grade and pass rate ($P = 0.34$, χ^2).

114 Part 2 Oral candidates were successful from 154 (74.03%) attempts November 2014–April 2016 (when the examination changed to the current format); Figure 2. Although those who took the exam in ST6 were most likely to pass (83.61%), this did not reach significance ($P = 0.07$, χ^2).

Most candidates took the Fellowship Part 1 exam in Foundation Year 2 (169, 39.7%), Figure 1; however, at this stage candidates have a significantly lower chance of passing the examination. Nevertheless, those that are keen to enter OST and feel prepared should not be discouraged from taking the examination.

We did not find any association between training grade and passing the Refraction Certificate, likely because refraction is a practical skill not associated with OST stage.

Most candidates sat their Part 2 Written in ST5 (200, 37.0%) and Oral in ST6 (61, 39.6%). We did not find any statistical difference between training grade and passing the Written component. There was potentially a trend towards significance for sitting the oral examination in OST6.

We do not account for candidates resitting examinations and we do not account for ophthalmology experience outside OST, two weaknesses of our study.

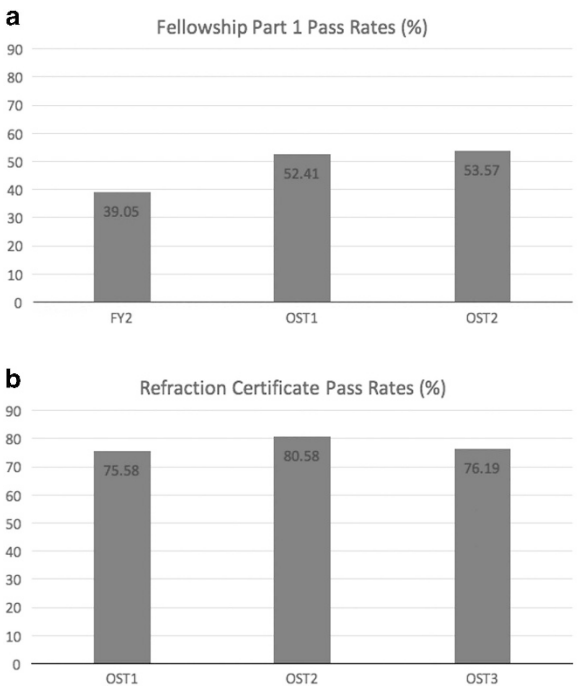

Figure 1 (a) Fellowship Part 1 Percentage Pass Rate by Training Grade; FY2 $n = 169$, ST1 $n = 145$, and ST2 $n = 112$. (b) Refraction Certificate Percentage Pass Rate by Training Grade; OST1 $n = 86$, OST2 $n = 103$, and OST3 $n = 126$.

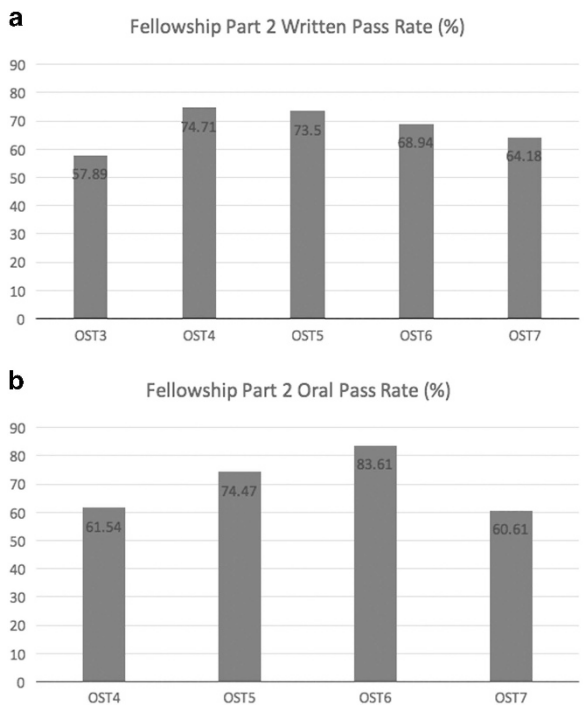

Figure 2 (a) Fellowship Part 2 Written Percentage Pass Rate by Training Grade; OST3 $n = 19$, OST4 $n = 87$, OST5 $n = 200$, OST6 $n = 161$, and OST7 $n = 67$ (OST1 3 attempts 0% pass rate and OST2 4 attempts 75% pass rate are not displayed on the graph. (b) Fellowship Part 2 Oral Percentage Pass Rate by Training Grade; OST4 $n = 13$, OST5 $n = 47$, OST6 $n = 61$, and OST7 $n = 37$.

However, the data does provide a useful insight into current pass rates and indicates that most trainees attempt examinations in a timely fashion, benefits of OST are seen in Part 1 pass rates and may be seen in Part 2 Oral pass rates.

Conflict of interest

The authors declare no conflict of interest.

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Sir,
SIA-formula: an easy way to calculate surgically induced astigmatism

$$\mathrm{SIA} = \sqrt{\left(A_f \cos\alpha_f - A_0 \cos\alpha_0\right)^2 + \left(A_f \sin\alpha_f - A_0 \sin\alpha_0\right)^2}$$

where:

SIA = corneal surgically induced astigmatism (in D),
A_f = final corneal astigmatism (in D),
α_f = final angle of cornea steepest meridian,
A_0 = initial corneal astigmatism (in D),
α_0 = initial angle of cornea steepest meridian.

The evolution and perfecting of cataract surgery technique poses an increasing relevance on refractive success. Astigmatism management is hence key. The knowledge and application of one's surgically induced astigmatism (SIA) is essential for toric IOL implantation and an important step for any phaco surgeon striving for cataract surgery proficiency.

This formula enables single case quantitative calculation of the change in corneal astigmatism after cataract phacoemulsification surgery. It can also be applied in any other surgery or situation when astigmatism is regular. It works for with the rule and against the rule astigmatism. It has been obtained by means of basic trigonometry calculations (Figure 1) and to the knowledge of the author and after extensive research it has not been published before in this or an equivalent form. It is based on vector calculations but obviates the need of drawing while providing more exact results.

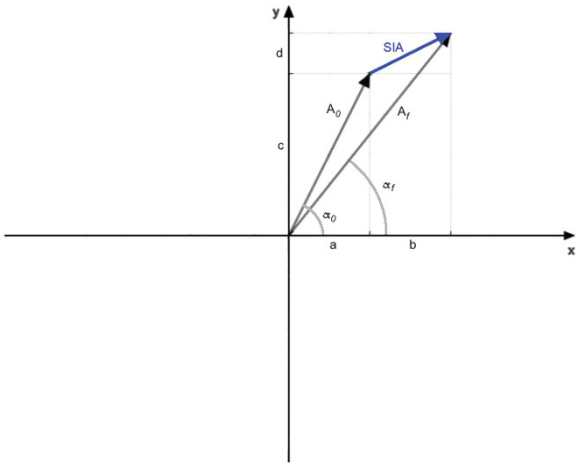

Figure 1 Initial and final astigmatism can be represented as vectors A_0 and A_f. Parallel lines to the axis are drawn with resulting right-angle triangles. By the trigonometric functions of sine and cosine:

$$\cos\alpha_0 = \tfrac{a}{A_0} \rightarrow a = A_0 \cos\alpha_0,$$
$$\cos\alpha_f = \tfrac{a+b}{A_f} \rightarrow b = A_f \cos\alpha_f - A_0 \cos\alpha_0,$$
$$\sin\alpha_0 = \tfrac{c}{A_0} \rightarrow c = A_0 \sin\alpha_0,$$
$$\sin\alpha_f = \tfrac{c+d}{A_f} \rightarrow d = A_f \sin\alpha_f - A_0 \sin\alpha_0.$$

SIA, b and d form another right-angle triangle where SIA is the hypotenuse. Applying Pythagoras' theorem:

$$\mathrm{SIA}^2 = b^2 + d^2$$
$$\mathrm{SIA} = \sqrt{b^2 + d^2},$$
$$\mathrm{SIA} = \sqrt{\left(A_f \cos\alpha_f - A_0 \cos\alpha_0\right)^2 + \left(A_f \sin\alpha_f - A_0 \sin\alpha_0\right)^2}.$$

Angle determination of the SIA can be obtained by the tangent function:

$$\tan\alpha_{\mathrm{SIA}} = \tfrac{d}{b},$$
$$\alpha_{\mathrm{SIA}} = \tan^{-1}\tfrac{d}{b},$$
$$\alpha_{\mathrm{SIA}} = \tan^{-1}\tfrac{A_f \sin\alpha_f - A_0 \sin\alpha_0}{A_f \cos\alpha_f - A_0 \cos\alpha_0},$$

where α_{SIA} is the angle of the meridian where more steepening occurs, the most flattened meridian will be perpendicular to it, at $\pm 90°$.

Excellent applications that allow multi-patient analysis of SIA are available for download[1] (https://sia-calculator.com) and surgeons are encouraged to use them. There may be circumstances, however, when a quick case calculation is needed or such resources are simply not available. In such cases this formula enables anyone with a scientific calculator, online or else, to quickly determine the SIA. The only required data are initial corneal astigmatism magnitude and axis and final corneal