

# The Royal College of Ophthalmologists

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FROM THE EXAMINATIONS DEPARTMENT



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## Final Report July 2010 Refraction Certificate Examination

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## Introduction

The second Refraction Certificate examination in the new format was held in Glasgow on 12<sup>th</sup> and 13<sup>th</sup> July 2010. 47 candidates presented themselves for the examination of whom 25 (53%) passed. The examination consisted of an 8 station OSCE covering a range of skills required to assess visual acuity, refractive error and the prescription of spectacles.

## Examination blueprint

The Refraction Certificate (RCert) is designed to assess the following learning outcomes from the Royal College of Ophthalmologists curriculum for ophthalmic specialist training (OST):

CA2	Vision
CA7	Motility
PM1	Management plan
PM14	Spectacles
PS2	Refraction
PS21	Hand hygiene
C1	Rapport
C2	Communication
C12	Records
BCS6	Optics
BCS14	Instrument technology
AER16	Time management

## Examination Structure

Eight OSCE stations are selected from a possible 16. Four stations are compulsory (they will appear in every examination). Four stations are selected from the remaining twelve.

### Compulsory stations:

1. Cycloplegic Retinoscopy
2. Non Cycloplegic Retinoscopy
3. Subjective Refraction Sphere
4. Subjective Refraction Cylinder

### Remaining stations

5. Binocular Balance
6. A second Cycloplegic Retinoscopy
7. Focimetry
8. Lens Neutralisation
9. Muscle Balance with Maddox Rod
10. Muscle Balance with Prism Cover Test
11. Near Addition
12. A second non Cycloplegic Retinoscopy
13. Refraction of a Model Eye
14. Trial Frame Fitting and Interpupillary Distance (IPD) Measurement
15. Visual Acuity and Refraction Estimation
16. Visual Acuity Testing of a Child

The stations used in the July examination were:

1. **Cycloplegic retinoscopy**
2. **Duochrome test**
3. **Non-cycloplegic retinoscopy**
4. **Trial frame**
5. **Subjective refraction cylinder**
6. **Focimetry**
7. **Subjective refraction sphere**
8. **Lens neutralisation**

### **Standard setting**

Candidates must be able to accurately assess visual acuity, measure refractive error and recommend an appropriate spectacle correction to pass the RCert. The pass mark was identified using two different methods:

### **Borderline candidate method (BCM)**

Examiners marked the station they were supervising according to the marking guidance provided. In addition they were asked to rate the candidates overall performance as a pass, a fail or borderline. The median mark allocated to the borderline candidates then becomes the pass mark for that station. The sum of the borderline marks for each station is the examination pass mark.

### **Hofstee method**

In advance of the examination, members of the College's Examinations Committee were asked to nominate the values for the following:

1. The maximum credible pass mark for the examination (80%)
2. The maximum credible pass rate for the examination (75%)
3. The minimum credible pass mark for the examination (50%)
4. The minimum credible pass rate for the examination (10%)

The cumulative fail rate as a function of the pass mark and the co-ordinates derived from the four values above were plotted on a graph. The point where a line joining the two co-ordinates intersects the cumulative function curve is used to identify the pass mark.

The pass mark for the examination is the sum of the BCM pas mark and one standard error of measurement (SEM), which is calculated after the examination results are known.

## Results (Table 1)

Maximum possible mark	100
Mean candidate mark	74
Median candidate mark	76
Standard deviation	10.6
Highest candidate mark	93
Lowest candidate mark	51
Range of marks	42
Reliability	0.6
Standard error of measurement (SEM)	7.6
BCM pass mark	67.5
Hofstee pass mark	72
Pass mark used (BCM + 1 SEM)	75
Pass rate	25/47 (53%)

## Distribution of marks (Table 2)

<46		0
46-50		0
51-55	///	0
56-60	////	5
61-65	/	1
66-70	//// //	8
71-75	//// /	6
76-80	//// //// /	11
81-85	//// //	9
86-90	//	2
>90	//	2

The distribution of marks shows that there is still a bimodal distribution with the majority of candidates centred around 76-80 mark and a small number performing badly who are centred around the 56-60 mark.

## Statistics for each station (Table 3)

	Station							
	1	2	3	4	5	6	7	8
	Cyclo ret	Duo	Non cyclo ret	Trial frame	Subjective cyl	Focimetry	Subjective sphere	Lens neutralise
Station mark	15	15	15	5	15	10	15	10
Mean	10.2	10.6	12.4	4.5	9.5	8.6	11.7	6.2
Mean%	<b>68.2</b>	<b>70.4</b>	<b>82.7</b>	<b>89.4</b>	<b>63.1</b>	<b>85.7</b>	<b>78.3</b>	<b>62.3</b>
Median	10.0	11.0	13.0	5.0	10.0	9.0	13.0	6.0
Med%	66.7	73.3	86.7	100.0	66.7	90.0	86.7	60.0
SD	3.0	2.7	1.9	0.7	3.6	1.8	3.6	2.7
Max	15	14	15	5	14	10	15	10
Min	5	3	9	2	2	2	2	1
Range	10	11	6	3	12	8	13	9

## Global judgments for each station (Table 4)

	Station (number of candidates)							
	1	2	3	4	5	6	7	8
	Cyclo ret	Duo	Non cyclo ret	Trial frame	Subjective cyl	Focimetry	Subjective sphere	Lens neutralise
Pass	12	24	29	34	18	32	37	21
Borderline	6	14	15	12	20	8	4	14
Fail	29	9	3	1	9	7	6	12
% Pass	26	51	62	72	38	68	79	45

## Distribution of marks for each station (all stations weighted at 15 marks) (Table 5)

		Station (number of candidates)							
		1	2	3	4	5	6	7	8
		Cyclo ret	Duo	Non cyclo ret	Trial frame	Subjective cyl	Focimetry	Subjective sphere	Lens neutralise
≤75%	Pass	20	29	35	42	22	38	33	19
50% to 75%	Border fail	15	12	12	4	13	7	7	14
25% to 50%	Fail	12	4	0	1	5	1	4	10
≤25%	Bad fail	0	2	0	0	7	1	3	4
% Pass		43	62	74	89	47	81	70	40

Correlation between global judgments and actual performance in each station:

Global judgment: pass and mark of 75% or greater:	0.87
Global judgment: borderline and mark between 50 and 75%	0.34
Global judgment: fail and mark of less than 50%	0.67

## Correlation between stations (Table 6)

		2	3	4	5	6	7	8
		Duo	Ret	Trial	Subj	Focim	Subj	Neutral
1	Ret	-0.150	<b>0.236</b>	0.028	0.097	0.142	0.142	0.036
2	Duo		-0.288	0.136	-0.033	0.269	0.006	0.320
3	Ret			-0.043	0.274	-0.186	0.318	0.125
4	Trial				0.240	0.264	0.046	0.064
5	Subj					0.350	<b>0.491</b>	0.368
6	Focim						0.196	<b>0.224</b>
7	Subj							0.306

Best correlation between:

Subjective refraction modification sphere and cyl: 0.491

Poorest correlation between:

Non-cycloplegic retinoscopy and duochrome test: -0.288

Modest correlation between:

Subjective refraction (cyl) and focimetry 0.350

Subjective refraction (cyl) and lens neutralisation 0.368

Non-cycloplegic retinoscopy and subjective refraction (sphere) 0.318

Duochrome test and lens neutralisation 0.320

Subjective refraction (sphere) and lens neutralisation 0.306

**Breakdown of results by training (Table 7)**

	Failed	Passed	Total
In OST	13	20	33
Not in OST	9	5	14
Total	22	25	47

These differences are not statistically significant ( $p = 0.21$ )

**Breakdown of results by Deanery (Table 8)**

	Failed	Passed	Total
East Midlands	0	3	3
East of England	1	0	1
London	0	9	9
Mersey	1	3	4
North Western	0	1	1
Northern	2	1	3
Northern Ireland	0	1	1
Peninsula	3	0	3
West Midlands	2	0	2
Wales	1	0	1
Yorkshire	3	2	5
	13	20	33

**Breakdown of results by Gender (Table 9)**

	Failed	Passed	Total
Female	6	15	21
Male	16	10	26
Total	22	25	47

These differences are statistically significant ( $p = 0.05$ )

**Breakdown of results by country of qualification (Table 10)**

	Failed	Passed	Total
UK	9	18	27
Outside UK	13	7	20
Total	22	25	47

These differences are not statistically significant ( $p = 0.06$ )

**Breakdown of results by declared ethnicity (Table 11)**

	Failed	Passed	Total
Asian Indian	9	3	12
Asian Other	3	4	7
Asian Pakistani	2	1	3
Black African	1	0	1
Chinese	1	4	5
Middle Eastern	0	1	1
Mixed	1	1	2
Unknown	1	2	3
White British	2	3	5
White Irish	0	3	3
White Other	2	3	5

These differences are not statistically significant ( $p = 0.26$ )

**Breakdown of results by number of previous attempts (Table 12)**

Attempts	Failed	Passed	Total
1 (First)	12	16	28
2	6	7	13
3	2	2	4
4	0	0	0
5	2	0	2
Any resit	10	9	19
Total	22	25	47

**Comparison with previous examination (Table 13)**

	March 2010	July 2010
Candidates	43	47
Pass mark	69	75
Pass rate	47%	53%
Reliability	0.58	0.6
SEM	9	8
% Candidates in OST	67%	70

## Feedback

### Candidate Feedback

In general candidate feedback was favorable. Those who had sat the same format in March said it was much improved with the minute gap between OSCEs (in the same room).

Comments included: time worked much better; no complaints - exam ran exactly as advertised on the web site; seemed very fair; lot of work gone into explaining the exam; appreciated the instructions; timing generally ok.

Not all candidates had this opinion. One candidate felt it was harder than the old style 30-minute refraction.

More than one had difficulty finishing the lens neutralisation station and focimetry within the time allowed. They also commented that the binocular balance station was difficult in the time. One more said 5 minutes not realistic for some of the stations.

There were still a problem with the lenses and the fixation devices. The lenses were mostly replaced in the correct positions - but some had been misplaced - however this problem was much improved over last sitting. The extra help was needed at times. No one complained of dirty/smeared lenses. One box had a broken +0.25 lens - i.e. had no handle. Other boxes had red as negative, brown and green colours, and handles on cylinders. All boxes had positive lenses on the right as you look at them.

Difficulty with the fixation devices revolved around imperial measurement, some showing a decimal fraction, and computers jamming. However the latter was not as often as at first sitting. Candidates asked if they could be warned about different lenses and fixation devices. All candidates agreed that it was helpful if the examiner changed the fixation device.

One candidate was unsure as to whether the achieved visual acuity in the subjective stations had to be written on the answer sheet. This could be made clearer on the instructions to candidates.

One candidate became confused about the two formats being available and used plus cylinder in one eye and negative cylinder in the other eye (despite him being warned not to do this). His fellow candidates in that stations disagreed with him - and agreed that the two formats had to be entertained.

One candidate had a patient for the non-cycloplegic refraction who did not have a trial frame fitted. The examiner had apologised to this candidate. Clearer instructions to the examiners could be given.

One candidate felt the focimeter reading element was not very bright.

One candidate had difficulty with neutralising a paediatric set of glasses, as the lenses were so small. One candidate worried about not bringing a felt tip pen to mark the optical centre of the lens.

More than one candidate questioned if they could mount up the lenses in their preferred format before the time began. This has been discussed at length and it was the sub-committee's opinion that this forms part of the exam so should be within the 5 minutes.



A frequent question from candidates was to know the tolerances of marking - in effect to view the marking guide. Senior Examiner explained that a decision not to publish this has been taken, although this will be reviewed. One suggested a shortened version might be helpful - indicating the tolerances allowed for maximum marks.

Several candidates indicated that it was difficult to practice on the oculus trial frame because they couldn't find one. One felt the plastic version better. Others had only found the open frame version.

### **Examiner feedback**

An examiners meeting was held on the afternoon of 12/7/10.

Overall the examiners found the first couple of candidates difficult, as they familiarised themselves with the format, what they were going to do, where they had to write, when they had to move patients around etc. However once they had a system, things ran smoothly.

We had a discussion about the correct answer for the duochrome.

The examiners were aware that tasks were not taking an equal time and some were very quick. They wondered about allowing faster candidates to progress onto the next station within the 10 or 11 minutes. Senior Examiner suggested this might decrease the reliability index. One examiner commented that the candidates struggled to finish the three tasks in the binocular balance station. Senior Examiner reminded him that they do not need to do all three and instructions say that only two need to be completed to receive full marks.

Examiners agreed that the lens neutralisation was time pressured and felt there was too much to do in time

They commented that they thought the standard was generally better and in particular someone has taught them to do cross cylinder correctly.

They felt that marking was intricate. One felt it was difficult to watch the next candidate because of thinking about last candidate marking. It was also difficult to write down comments and one examiner had forgotten once. One commented that scores don't make sense - some times get better mark if both cyls wrong axis than if only one

One examiner felt it was lonely on own.

Focimetry: glasses given had too small cylinders. Difficult to mark.

The subject for the subjective examination of cylinder happened to have a high tolerance of cylinder or no cylinder so not a good patient. Was previously 6/6 but could not get better than 6/9 today - not an easy patient. Nearly all candidates ran out of time.

## Summary

The second refraction certificate (RCert) examination attracted a similar number of trainees when compared to the last sitting, with a similar pass rate even though the pass mark was higher. The organisation of the examination has improved but there are still some stations that are difficult for some candidates to complete in the time available. There is some evidence that the clarity of the instructions to candidates is enabling them to better prepare, but some stations are performed badly, particularly by the weaker candidates.

The low reliability remains a problem. Some stations are performed well by almost all of the candidates (trial frame, non-cycloplegic retinoscopy, focimetry); whilst the performance in others is very variable (lens neutralisation, cycloplegic retinoscopy, subjective modification of the cylinder). Performance on very few stations is even reasonably correlated. The examination is not sustainable if the reliability does not improve and we can expect criticism from the GMC when the results of these two examinations are included in our annual report.

Possible reasons for the poor reliability:

- Candidates are not preparing well for all of the stations
- Factors other than candidate competence is impairing performance in some stations e.g. equipment, time, clarity of instructions, complexity of task, variation in acceptable practice that is not recognised in the examination
- Inconsistent marking by examiners
- Insufficient stations
- Poorly designed or irrelevant stations

If the number of stations were doubled (to 16) the reliability would increase to 0.81 (even if the marked variation in performance in some stations was not addressed). If performance in the stations became less variable (due to better candidate preparation, examiner training etc) then an increase by 4 stations would achieve a similar increase in reliability.

The examination does not appear to be more difficult for candidates from overseas or of different ethnicity. There is a marked variation in performance from different deaneries (all candidates from the London deanery passed, 7 at the first attempt). The performance of male candidates was worse than that of females.

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