

Examination Report

April 2014 Refraction Certificate Examination



The ROYAL COLLEGE of
OPHTHALMOLOGISTS

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1 Introduction

The thirteenth Refraction Certificate examination in the format was held in Birmingham on 23 and 24 April 2014. 56 candidates presented themselves for the examination. The examination consisted of a 12 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

The examination consists of 12 OSCE stations. Each station contributes a possible 15 marks to the overall total. The stations for the December 2013 examination were:

1. Cycloplegic Retinoscopy (CR1)
2. Cycloplegic Retinoscopy (CR2)
3. Subjective Refraction Cylinder (SRC)
4. Cycloplegic Retinoscopy (CR3)
5. Cycloplegic Retinoscopy (CR4)
6. Lens Neutralisation (LN)
7. Non Cycloplegic Retinoscopy (NCR1)
8. Non Cycloplegic Retinoscopy (NCR2)
9. Visual acuity and IPD measurement (VA)
10. Subjective Refraction Sphere (SRS)
11. Binocular balance (BB)
12. Near Addition (NA)

2 Summary and recommendations

This is the fifth sitting of the refraction certificate with 12 OSCE stations.

The Hofstee pass mark is relatively stable and was slightly higher than the BCM pass mark for this examination. This method of setting the pass mark will be used after August 2014.

The pass rate in OST was high which suggests that trainees are learning how to perform retinoscopy in preparation for the examination. A small number of candidates performed very badly.

Candidates performed well in all of the of the cycloplegic retinoscopy stations. The subjective refraction (cylinder) was poorly completed by candidates.

Station NCR2 was the most highly discriminating between poor and well performing candidates in the examination overall. The near add and CR4 were the poorest discriminating stations.

Female candidates were less successful, but there were no significant differences in performance based upon ethnicity, first language or country of qualification.

3 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 (see appendix 1 for details)

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
2. The maximum credible pass rate for the examination
3. The minimum credible pass mark for the examination
4. The minimum credible pass rate for the examination

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 Hofstee pass mark used to compare the difficulty of successive examinations.

4. Results (table 1)

Number of candidates	56
Maximum possible mark	180 (12 x 15)
Mean candidate mark	143.8 (79.8%)
Median candidate mark	147 (82%)
Standard deviation	15.4 (8.6%)
Highest candidate mark	169 (94%)
Lowest candidate mark	91 (51%)
Reliability	0.6
Standard error of measurement (SEM)	9.5 (5.3%)
BCM pass mark	122.5 (68%)
Hofstee pass mark	135 (75%)
Pass mark used (BCM + 1 SEM)	132 (73%)
Pass rate	47/56 (84%)
Pass rate in OST	33/37 (89%)
Pass rate if Hofstee mark had been used	44/56 (78%)

Distribution of marks (table 2)

Score	Distribution	Total
91-95	/	1
96-100		0
101-105	/	1
106-110	/	1
111-115	/	1
116-120		0
121-125		0
126-130	////	5
131-135	////	5
136-140	///	3
141-145	//// ////	10
146-150	//// //	7
151-155	//// //// /	11
156-160	//// /	6
161-165	///	4
166-170	/	1
Total		56

/ Candidate failed / candidate passed

Statistics for each station (table 3)

		Mean	Mean %	Median	Median %	Standard deviation	Minimum	Maximum
1	CR1	12.8	85	14	93	3 (20%)	4 (27%)	15 (100%)
2	CR2	12.4	83	14	93	3.1 (21%)	4 (27%)	15 (100%)
3	SRC	8.2	55	8	53	4.1 (27%)	1 (7%)	15 (100%)

4	CR3	13.2	88	15	100	2.9 (20%)	4 (27%)	15 (100%)
5	CR4	12.9	86	14	93	3.0 (20%)	2 (13%)	15 (100%)
6	LN	11.3	76	12	80	3.0 (20%)	1 (7%)	15 (100%)
7	NCR1	11.4	76	12	80	3.5 (23%)	1 (7%)	15 (100%)
8	NCR2	11.1	74	12	80	3.9 (26%)	1 (7%)	15 (100%)
9	VA	13.7	92	14	93	1.3 (9%)	9 (60%)	15 (100%)
10	SRS	12.3	82	13	87	2.8 (19%)	3 (20%)	15 (100%)
11	BB	12.0	80	12.5	83	2.9 (19%)	3 (20%)	15 (100%)
12	NA	12.1	80	13	87	2.3 (15%)	4 (27%)	15 (100%)

The relative weights for each skill in refraction (based upon the number of stations is:

Clinical skill	Number of stations	Contribution to total marks
Retinoscopy	6	50%
Subjective	3	25%
Other	3	25%

Correlation between stations (table 4)

	CR1	CR2	SRC	CR3	CR4	LN	NCR1	NCR2	VA	SRS	BB
CR1	1.0										
CR2	0.81	1.0									
SRC	-0.19	-0.22	1.0								
CR3	-0.01	-0.04	0.01	1.0							
CR4	0.07	0.02	0.02	0.55	1.0						
LN	0.05	-0.06	0.27	-0.03	0.05	1.0					
NCR1	0.11	0.10	-0.04	0.07	0.21	0.19	1.0				
NCR2	0.10	0.12	0.04	0.06	0.28	0.09	0.72	1.0			
VA	0.11	0.12	0.23	-0.05	-0.19	0.00	0.20	0.24	1.0		
SRS	-0.11	-0.13	0.25	0.18	-0.07	0.26	0.15	0.01	0.13	1.0	
BB	0.08	0.04	0.23	0.01	0.00	0.16	0.14	0.12	0.32	0.58	1.0
NA	0.11	0.21	0.18	-0.14	0.01	0.20	-0.06	-0.14	0.11	0.01	0.04

Median correlation between the cycloplegic refraction stations = 0.05

Correlation between non-cycloplegic refraction stations = 0.72

Best correlation between CR1 and CR2 (0.81) and NCR1 and NCR2 (0.72)

Poorest correlation between SRC and CR2 (-0.22)

Correlation between each station and the total score (table 5)

CR1	CR2	SRC	CR3	CR4	LN	NCR1	NCR2	VA	SRS	BB	NA
0.40	0.36	0.38	0.32	0.42	0.15	0.59	0.58	0.36	0.43	0.50	0.25

Item discrimination and facility

33% item discrimination has a value between -1.00 and +1.00. If the candidates who score well in the examination overall score well in the station, the item discrimination index will be close to +1.00. If the candidates who score poorly in the examination overall score well in the station, the item discrimination index will be close to -1.00. Ideally the station item discrimination value should be greater than 0.400. The facility of each station estimates how easy the candidates found the task to complete.

Utility of each question (Table 6)

Pass or fail on marks for each station

	Station	33% item discrimination	Item facility
1.	Cycloplegic Retinoscopy (CR1)	0.316	79
2.	Cycloplegic Retinoscopy (CR2)	0.263	80
3.	Subjective Refraction Cylinder (SRC)	0.421	63
4.	Cycloplegic Retinoscopy (CR3)	0.158	86
5.	Cycloplegic Retinoscopy (CR4)	0.105	84
6.	Lens Neutralisation (LN)	0.263	75
7.	Non Cycloplegic Retinoscopy (NCR1)	0.368	77
8.	Non Cycloplegic Retinoscopy (NCR2)	0.316	80
9.	Visual acuity and IPD measurement (VA)	0.211	79
10.	Subjective Refraction Sphere (SRS)	0.316	86
11.	Binocular balance (BB)	0.368	80
12.	Near Addition (NA)	0.105	89

Standard setting and global judgments for each station (table 7)

		Pass	Borderline	Fail	% Pass	BCM mark*	%
1	CR1	34	21	1	61	11	73
2	CR2	31	21	4	55	10	67
3	SRC	20	21	15	36	7	47
4	CR3	43	10	3	77	10.5	70
5	CR4	46	7	3	82	11	73
6	LN	34	18	4	61	11	73
7	NCR1	33	17	6	59	10	67
8	NCR2	34	16	6	61	9	60
9	VA	50	6	0	89	12.5	83
10	SRS	40	12	4	71	10	67
11	BB	39	12	5	70	10.5	70
12	NA	36	18	2	64	10	67
						122.5	68%

*BCM mark = median mark for borderline candidates for each station.

5. Breakdown of results

Breakdown of results by training (table 8)

	Failed	Passed	Total
In OST	4	33	37
Not in OST	5	14	19
Total	9	47	56

These differences are not statistically significant ($p = 0.25$)

Breakdown of results by deanery (table 9)

Deanery	Failed	Passed	Total
East Midlands	1	1	2
East of England	0	6	6
East of Scotland	0	0	0
KSS	0	0	0
London	1	4	5
Mersey	0	6	6
North Scotland	0	0	0
North West	0	2	2
Northern	0	0	0
Northern Ireland	0	0	0
Oxford	0	0	0
Peninsula	1	0	1
Severn	0	3	3
South East Scotland	0	1	1
Wales	0	1	1
Wessex	0	1	1
West Midlands	0	2	2
West Scotland	1	1	2
Yorkshire	0	5	5
Total	4	33	37

Breakdown of results by stage of training (table 10)

Stage (includes FTSTA)	Failed	Passed	Total
ST1	0	5	5
ST2	2	12	14
ST3	2	15	17
ST4	0	0	0
Total*	4	32*	36

*Level at examination unknown for 1 candidate

Breakdown of results by gender (table 11)

	Failed	Passed	Total
Female	8	22	30
Male	1	25	26
Total*	9	37	56

These differences are statistically significant ($p = 0.03$)

Breakdown of results by country of qualification (table 12)

	Failed	Passed	Total
UK	4	27	31
Outside UK	5	20	25
Total	9	47	56

These differences are not statistically significant ($p = 0.72$)

Breakdown of results by first language (table 13)

	Failed	Passed	Total
English	6	30	36
Not English	2	15	17
Total*	8	45	53

*Unknown for 3 candidates

These differences are not statistically significant ($p = 0.71$)

Breakdown of results by stated ethnicity (table 14)

	Failed	Passed	Total
Non-white	6	32	38
White	2	13	15
Total*	8	45	53

*Unknown for 3 candidates

These differences are not statistically significant ($p = 1.0$)

Breakdown of results by number of previous attempts (table 15)

Attempts	Failed	Passed	Total
1 (First)	5	30	35
2	4	11	15
3	0	1	1
4	0	2	2
5	0	2	2
6	0	1	1
Any resit	4	17	21
Total	9	37	56

6 Comparison to previous examinations (table 16)

Date	Candidates	Pass mark	Pass rate	Pass rate in OST	% Candidates in OST	Reliability	SEM	Hofstede pass mark
Mar 10	43	69%	47%	58%	67%	0.6	9 (9%)	68%
July 10	47	75%	53%	60%	70%	0.6	8 (8%)	72%
Nov 10	53	74%	42%	44%	68%	0.6	7 (7%)	71%
Apr 11	57	71%	35%	47%	63%	0.6	6 (6%)	67%
July 11	41	67%	66%	72%	71%	0.4	6 (6%)	71%
Nov 11	69	65%	71%	75%	70%	0.6	8 (8%)	68%
Mar 12	54	73%	54%	66%	57%	0.6	8 (8%)	72%
July 12	44	71%	59%	67%	64%	0.5	9 (9%)	71%
Dec 12	71	69%	75%	77%	55%	0.6	11(6%)	72%
Apr 13	64	74%	61%	64%	64%	0.8	11(6%)	74%
July 13	42	72%	74%	90%	48%	0.7	10(6%)	74%
Dec 13	75	72%	67%	76%	65%	0.7	10(6%)	71%
Apr 14	56	73%	84%	89%	66%	0.6	9.5(5%)	75%

Performance of candidate by deanery for all examinations to date, where deanery is known (table 17)

Deanery	Total passes	Total candidates	Pass rate %
East of Scotland	6	7	86
KSS	6	7	86
North Scotland	5	6	83
Oxford	5	6	83
Mersey	19	25	76
London	81	110	74
East Midlands	16	22	73
Northern	12	17	71
North West	16	23	70
South Scotland	7	10	70
East of England	19	28	68
West Midlands	28	41	68
Yorkshire	27	40	68
Wessex	10	15	67
Wales	12	19	63
Northern Ireland	6	10	60
Severn	9	15	60
West Scotland	6	11	55
Peninsula	7	20	35
TOTAL	297	432	69

Appendix 1 Hofstee method for standard setting

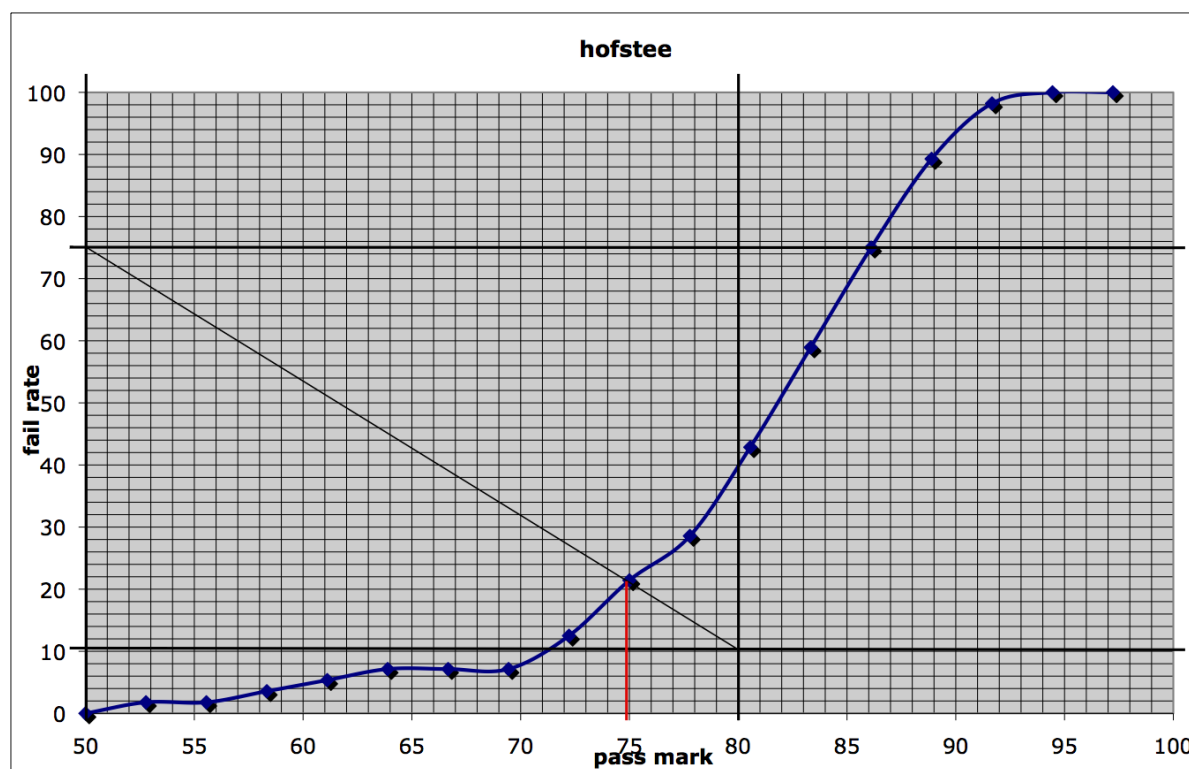
Hofstee method

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 144/180 (80%)
2. The maximum credible pass rate for the examination (75%)
3. The minimum credible pass mark for the examination 90/180 (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 Hofstee pass mark for this examination was 135/180 (75%), which is slightly higher than the BCM + 1 SEM pass mark. Using this pass mark the pass rate would have been slightly lower at 44/56 (78%)



Appendix 2: April 2014 - Refraction Certificate Candidate Feedback

OSCE stations

Were you treated in a courteous manner by the examiners in this examination?

Yes 13/13

No 0/13

Comments

- All of the examiners were very professional and even gave feedback after the exam informally.
- The examiners were courteous and reassuring
- On the cyl refinement station however some of the lenses were missing from the trial lens set. These were eventually found with the examiner as the patient had changed prescription. This took up time that should have been utilized in preparing for station.
- one of the examiners however asked me if I knew what I was doing when I was checking my answers. She also didn't tell me I had one minute left and grabbed my answer sheet at the end of my time.
- Examiners were so nice and supportive

Were the patients you were asked to examine appropriate for the examination?

Yes 13/13

No 0/13

Comments

- Suitably calm patients allowing candidates to perform examinations without distraction.
- Except patient on refinement of cyl. It was difficult to interpret lines read as she insisted '3 lines from bottom' which were inaccurate letters.
- However, one of the patients read all letters on the line she could see wrong. Maybe that was her brief?
- One patient – gave frequently unreliable answers for subjective station
- Patient were cooperative

The OSCE overall

Was the OSCE well organized?

Yes 13/13 (One candidate said yes and no)

No 01/13

Comments

- I was very disappointed with my first station as you may be aware with the retinoscope provided which was running low on batteries. Thankfully the examiner acknowledged this and made an attempt to restore it. Meanwhile 2 other consultants came and offered their retinoscopes which were also running low on batteries. Decision was made that I should continue with whatever I have got which I

ultimately did. Also one of the examiner said that it was the trial frame which was at a slant was obstructing the reflection. Here I could explain that because the station was stopped I decided to loosen the heavy frame from the patient's nose where 3 lenses were sitting for which the patient thanked me unfortunately I did not get a chance to explain this. But the patient is a proof to this. Also when I was asked to continue with the same retinoscope on the patient I started to panic but the patient said do best what you can with this and ultimately I did. Obviously a patient who has poor reflex and a retinoscope with poor light was not the best combination and proved to be a disaster for me. I heavily lost on the marks which involved both the eyes involving 30 marks. Hence the result I failed. It is too much to pay £600 everytime especially this time when the retinoscope was not in the proper order and also when I have done quite well with the other refraction stations. Also there was the near reading station where I was given a clear pass but only given 1 mark for noting down the prescription.

- Good pre-exam space and brief with all stations sensibly arranged.
- Extremely well organized
- Timer would have been beneficial. As we were told we could have used our phones on airplane mode.
- I wish I had known that I could take my iphone in with me as timer on airplane mode. It was only decided on the morning of my exam that we were allowed to do so (9am on Day 2). However, the examinations team were very kind to offer me their wrist watch and iphone. Thanks.
- Very Well run
- I was the only candidate who wasn't given a rest station. I have started with the empty station then had to take the whole exam without rest. This was reflected on my performance in the last 3 OSCEs. I had no rest!

Were you given clear instructions about the OSCE?

Yes 13/13

No 0/13

Comments

- The examiners were very informative and before the examination started, one of the examiners was available to answer any questions that we had re: equipment, watches, answer sheets.
- There were no surprises and we were given clear instructions
- Clear instructions given both in the candidate handbook and also at the venue prior to the exam

Did you feel that the OSCE was a fair assessment of your knowledge?

Yes 11/13 (2 x Candidates answered yes and no)

No 02/13

Comments

- It is difficult for me to comment as I have been practicing refractions from retinoscopy to refinement of sphere and cyl then binocular balance. In that way I find that it flows and I can correct mistakes along the way whereas doing the exam stations in isolation makes it difficult to assess accurate refraction.
- It is hard to say for this because I find that it's important to be able to show that you know the routine from beginning to the end. I find that I tend to be able to claw back

my ret results through sphere and cyl refinement. However, I have no opportunity to demonstrate this ability in the exam and I am not sure of the tolerance of our final prescription.

Exam Preparation

Who helped you to develop competence in refraction? (Please tick the answer as appropriate)

- | | | |
|--------------------------|----------------------------|---|
| <input type="checkbox"/> | Optometrist | 12 |
| <input type="checkbox"/> | Consultant ophthalmologist | 1 |
| <input type="checkbox"/> | Fellow trainee | 5 |
| <input type="checkbox"/> | Self-taught | 9 |
| <input type="checkbox"/> | Other (please list) | Dundee refraction course
Refraction Course
Course
Root Eye Network / Rootatlas.com |

Question 2

Approximately how many complete refractions (retinoscopy + subjective modification) did you carry out in your preparation for the examination?

- More than 300
- About 100
- Approx 80 rets and 30-40 subjective refractions
- 100's
- 100
- 35
- 80
- ~40
- 35-40
- Approx 75
- Unsure. 30-80 maybe
- >100
- 30

Question 3

Please provide any other advice that you would like to share with future candidates.

- Please bring your own retinoscopes. I was unfortunate on that day my retinoscope broke down Please candidates ignore the statement in the letter which says strongly recommend to bring their own retinoscopes rather it should be read as no retinoscopes to be provided. I had problem in 2 stations with this.
- Practice on real patient until all techniques are second nature.
- I found the metal oculus trial frame to be quite stiff when inserting lenses. If possible, I would advise candidates to bring a trial frame that they are familiar with to use during the exam.
- Don't start each station until you are ready.
- Practice doing each station using the mark sheet provided and stick to the allocated time. Always use the last minute to fill in your answer.
- Practice.

- Practice, Learn from optoms as they are best I think, Attend courses cause they are helpful re guidance, Mock exams are great for assessment.
- Courses run by optoms are most useful (I learned negative cyls) and doing mock exams are useful.
- Practice under exam conditions and remember to leave yourself time to write down your answers. See below but I wonder whether it would be possible for the College to release the visual acuity program so that candidates can be familiar with the computerized software.
- Spend time with optoms
- Practicing as many retinoscopy as they can. Ensure they practice cycloplegic retinoscopy as well as non cycloplegic. I found the cycloplegic more difficult (many reflexes)

Please write any other comments you have about the Refraction Certificate Exam below.

- Very well organised exam but I do not think it reflects how good the candidate is at performing refraction.
- Useful to provide margin of error allowed for passing exam.
- would be useful to know how much tolerance is acceptable for prescription
- The exam was extremely well organised except for 1 station – the Jackson Cross Cylinder. Sadly the examiner had little idea how to operate the computerized visual acuity program and was unable to find a suitable chart for me. At one stage during the station, the chart went completely blank and had to be corrected by the “Patient” who was an optometrist student more familiar with the program. Sadly even at this stage the chart was not full screen so not fully representative of an actual acuity chart. I lost at least a minute of time from this station and I gather other candidates had similar problems. Hopefully this will be taken into account when the stations are calibrated.
- Giving more time between stations would be more appropriate.. Thank you