NICE advice

ORA G3 to measure corneal hysteresis

Medtech innovation briefing
Published: 18 June 2018
nice.org.uk/guidance/mib150

Summary

- The **technology** described in this briefing is Ocular Response Analyzer (ORA) G3. It can be used to measure corneal hysteresis, a possible risk factor for glaucoma.
- The **innovative aspects** are that ORA G3 is currently the only device capable of measuring corneal hysteresis.
- The intended **place in therapy** would be when diagnosing and managing suspected glaucoma or monitoring established glaucoma. ORA G3 would be used in addition to standard care, specifically ophthalmic tests including Goldmann applanation tonometry.
- The **main points from the evidence** summarised in this briefing are from 5 observational studies, 4 in the US and 1 in Korea, including a total of 635 adults recruited from glaucoma clinics. Results show that lower levels of corneal hysteresis are associated with the development and progression of glaucoma.
- **Key uncertainties** around the evidence or technology are whether the published studies are applicable to the NHS, and if corneal hysteresis is indeed a reliable risk factor for glaucoma.
- The **cost** of ORA G3 is £11,995 per unit (excluding VAT), plus additional costs for maintenance and consumables. The **resource impact** would be greater than standard care, but using ORA G3 may provide more long-term savings if measuring corneal hysteresis allows for earlier diagnosis and treatment of glaucoma.

The technology

Ocular Response Analyzer (ORA) G3 (Reichert Technology) is a dynamic bidirectional applanation device used to measure corneal hysteresis.

ORA G3 is table-mounted and controlled by a healthcare professional through an in-built operator display. The patient positions their head in a headrest, which is adjusted to allow for measurements of the left or right eye. The device blows a short puff of air to slightly flatten the cornea, which then returns to its original shape. During this the device takes 2 measurements: the force needed to flatten the cornea and the force needed for it to reshape. The difference between the 2 measurements is defined as the level of corneal hysteresis (measured in mmHg).

ORA G3 can also be used to measure intraocular pressure, but this briefing focuses on its use to measure corneal hysteresis.

Innovations

ORA G3 is currently the only device that can measure corneal hysteresis. Unlike other tests, it does not need contact with the eye, specialist training or the use of eye drops.

Current NHS pathway

The NICE guideline on glaucoma recommends several tests to diagnose and manage glaucoma (see table 2). The guideline does not include recommendations on measuring corneal hysteresis specifically, but some evidence suggests that lower levels of corneal hysteresis may be linked to the development or progression of glaucoma.

Population, setting and intended user

ORA G3 is intended as an additional option for diagnosing or managing suspected glaucoma, or for monitoring established glaucoma. It is possible to have open angle glaucoma without raised intraocular pressure, so measuring corneal hysteresis could be more useful in this patient group. Assessments using ORA G3 would usually be done in secondary care by a healthcare professional or trained technician. The company has stated that minimal training is needed to use the device.

Costs

Technology costs

The estimated cost per test with ORA G3 is £0.20.

This has been calculated by dividing the total cost of the device, service and maintenance fees, and consumables by the number of patients that would have the test in 10 years (the predicted lifespan of the device; this equates to 75,000 patients). The estimated cost per test does not include the time of a healthcare professional.

Table 1 Costs for ORA G3

Description	Cost	Additional information
ORA G3 device	£11,995.00	The expected lifespan of the device is 10 years.
Biannual service and maintenance	£395.00 per service	Over 10 years, 4 services would be needed.
Alcohol wipes	£0.02 each	The company estimates that around 30 patients would have an ORA G3 test each day.
All costs were provided by the company.		

Costs of standard care

Table 2 shows estimated costs for each of the tests recommended by NICE as an option for diagnosing and managing glaucoma. The estimates do not include the cost of consumables or the time of a healthcare professional. Excluding these, the average cost per test is £0.09.

Table 2 Costs of tests to diagnose and manage glaucoma

Test	Cost per patient
Measuring intraocular pressure using Goldmann applanation tonometry	£0.09
Optic nerve assessment and fundus examination	£0.04
Gonioscopy	£0.14
Measuring central corneal thickness	£0.09

Visual field assessment using standard automated perimetry	£0.09

Resource consequences

The resource impact of ORA G3 would be greater than standard care at first because the test is more costly. However, the company claims that after the first year, ORA G3 becomes cost saving for the rest of the device's lifespan (that is, 10 years). If corneal hysteresis were proven to be a risk factor for glaucoma, and ORA G3 enabled earlier diagnosis, there may be associated cost savings from starting treatment sooner.

If ORA G3 were adopted by the NHS, ophthalmology care providers would need to accommodate the device in examination rooms or clinic areas.

ORA G3 is currently being used in 8 NHS hospitals.

Regulatory information

ORA G3 was CE marked as a class IIa device in 2005.

Equality considerations

NICE is committed to promoting equality, eliminating unlawful discrimination and fostering good relations between people with particular protected characteristics and others. In producing guidance and advice, NICE aims to comply fully with all legal obligations to: promote race and disability equality and equality of opportunity between men and women, eliminate unlawful discrimination on grounds of race, disability, age, sex, gender reassignment, marriage and civil partnership, pregnancy and maternity (including women post-delivery), sexual orientation, and religion or belief (these are protected characteristics under the Equality Act 2010).

Glaucoma is more common in older people, so they are more likely to benefit from ORA G3. Age is a protected characteristic under the Equality Act 2010.

Clinical and technical evidence

A literature search was carried out for this briefing in accordance with the interim process and methods statement. This briefing includes the most relevant or best available published evidence relating to the clinical effectiveness of the technology. Further information about how the evidence for this briefing was selected is available on request by contacting mibs@nice.org.uk.

Published evidence

This briefing summarises 5 studies; 4 done in the US and 1 done in Korea, including a total of 635 adults with glaucoma (822 eyes). Three were prospective cohort studies (n=400) and 2 were retrospective studies (n=235).

Table 3 summarises the clinical evidence as well as its strengths and limitations.

Overall assessment of the evidence

The results of all 5 studies suggest that corneal hysteresis is associated with the development and progression of glaucoma. Three studies also showed correlations between corneal hysteresis and corneal central thickness, and 2 studies showed correlations between corneal hysteresis and intraocular pressure.

None of the studies was conducted in the UK so the results may not be generalisable to the NHS.

The company claims that ORA G3 will benefit people with suspected glaucoma, as well as people with a confirmed diagnosis of glaucoma. However, only 1 of the studies (n=199) included people with suspected glaucoma.

Prospective, controlled, UK studies that assess the value of measuring corneal hysteresis alongside standard of care would be useful.

Table 3 Summary of selected studies

Susanna et al. (2018)	
Study size, design and location	A prospective observational cohort study of 199 adults (287 eyes) with suspected glaucoma in the US.
Key parameters of interest	• CH • IOP • CCT

Key outcomes	CH measurements at baseline were significantly lower in people who developed glaucoma compared with those that did not (9.5±1.5 vs 10.2±2.0 mmHg, p=0.012). Each 1 mmHg lower CH was associated with a 22% increase in the risk of developing glaucoma during follow-up (HR=1.22, 95% CI 1.04 to 1.41, p=0.013). In multivariable analysis, adjusted for age, IOP, CTT and PSD, CH was still predictive of glaucoma (HR=1.20, 95% CI 1.01 to 1.42, p=0.039).
Strengths and limitations	The study recruited a relatively large group of people but in a non-UK setting. Adults with suspected glaucoma were included. The patient population in other studies are people with established glaucoma.
De Moraes et al. (2012)	
Study size, design and location	A retrospective study of 153 adults with glaucoma (153 eyes) in the US.
Key parameters of interest	• IOP • CCT • CH • CRF • IOPg • IOPcc
Key outcomes	Eyes that had VF progression had lower CH compared with non-progressing eyes (7.5±1.4 vs 9.0±1.8 mmHg). There was a moderate and significant correlation between CH and CCT (r=0.33, p<0.01). In multivariate analysis, CH was the corneal parameter most strongly associated with VF progression (OR 1.55, CI 1.14 to 2.10, p<0.01).
Strengths and limitations	The study recruited a relatively large number of adults but in a non-UK setting.
Zhang et al. (2016)	

Study size, design and location	A prospective observational cohort study of 133 adults with glaucoma (186 eyes) at a glaucoma centre in the US.
Key parameters of interest	• CH • CCT • GAT IOP
Key outcomes	In univariate analysis, each 1 mmHg lower CH was associated with a 0.13 micrometre per year faster rate of RNFL loss (p=0.011). In multivariable analysis adjusting for age, race, average GAT IOP and CTT, CH was still associated with a faster rate of RNFL loss (p=0.015). CCT was not found to be associated with RNFL loss.
Strengths and limitations	The study recruited a relatively large number of people. A limitation of the study is that treatment was decided by the attending ophthalmologist and not standardised. Different treatment options may have influenced progression rates.
Medeiros et al. (2013)	
Study size, design and location	An observational cohort study of 68 adults with glaucoma (114 eyes) at a glaucoma centre in the US.
Key parameters of interest	• CH • GAT IOP • CCT
Key outcomes	In univariable analysis, each 1 mmHg lower CH was associated with 0.25% per year faster rate of VF decline over time (p<0.001). In multivariable analysis the authors concluded that there were a significant interaction between IOP and CH. There was a relationship between CCT and CH (r=0.48, p<0.001).
Strengths and limitations	A relatively small number of adults was recruited into the study.

Park et al. (2015)	
Study size, design and location	A retrospective cross-sectional observational study of 82 adults with NTG (82 eyes) at a glaucoma clinic in Seoul, Korea.
Key parameters of interest	• IOP • CCT • CRF • CH • IOPg • IOPcc
Key outcomes	26 of 39 eyes with low CH had progression of VF damage compared with 15 of 43 eyes with high CH ($p<0.01$). In univariate and multivariable regression analysis CH was significantly correlated with VF progression (univariate beta=0.39, $p<0.01$, multivariable beta=0.32; $p=0.01$). CH had a moderate and significant correlation with CCT ($r=0.44$, $p<0.01$) and IOPcc ($r=-0.52$, $p<0.01$).
Strengths and limitations	Study participants were having anti-glaucoma medications. CH may have been increased by IOP-lowering therapy. A relatively small number of adults were recruited into the study.
Abbreviations: CCT, central corneal thickness; CH, corneal hysteresis; CRF, corneal resistance factor; IOP, intraocular pressure; IOPcc, corneal compensated intraocular pressure; IOPg, Goldmann estimated intraocular pressure; PSD, pattern standard deviation; RNFL, retinal nerve fibre layer; VF, visual field.	

Recent and ongoing studies

No ongoing or in-development trials were identified.

Specialist commentator comments

Comments on this technology were invited from clinical specialists working in the field and relevant patient organisations. The comments received are individual opinions and do not represent NICE's view.

All 5 specialist commentators were familiar with or had used ORA G3 before.

Level of innovation

One specialist commentator confirmed that ORA G3 is the only device that can measure corneal hysteresis, but noted that how well corneal hysteresis predicts glaucoma is unproven.

Potential patient impact

One specialist commentator remarked that if a well-conducted, prospective study did show that corneal hysteresis was a reliable risk factor for glaucoma it could lead to better patient outcomes, specifically: better detection of the disease, earlier treatment, and fewer assessments for people at low risk of development or progression.

Another stated that ORA G3 may improve clinical outcomes by identifying people at high risk of development or progression through measuring corneal hysteresis. People determined to be at low risk would need fewer hospital visits and less treatment.

Potential system impact

The specialist commentators stated that if corneal hysteresis were proven to be a reliable risk factor for glaucoma, it would allow for more accurate targeted follow-up. This would mean less unnecessary treatment for people at lower risk.

One specialist commentator said that because ORA G3 is an extra test, it will increase costs. However, they acknowledged that it has the potential to be cost saving over time.

Another specialist commentator noted that ORA G3 could reduce the number of senior or specialist staff needed in a clinic. Because the device is relatively easy to use and does not need eye drops or contact with the eye, it can be used by more junior staff.

Another commentator suggested that ORA G3 could be used instead of current intraocular pressure measurement in primary and secondary care.

General comments

One specialist commentator felt that corneal hysteresis is not a proven risk factor for glaucoma. Another considered corneal hysteresis to be a risk factor but, thought that corneal compensated intraocular pressure was most useful clinically. A third specialist commentator did not think that corneal hysteresis was a risk factor but observed that it may be a helpful indicator for patients who cannot have some of the tests recommended by NICE. Another explained that they use corneal hysteresis as a marker for measurement error by Goldmann applanation tonometry, rather than a risk factor in itself.

Two specialist commentators felt that as an extra device, finding space for ORA G3 in a clinic may be an issue. However, most of the commentators did not foresee any problems with space for the device.

Specialist commentators

The following clinicians contributed to this briefing:

- Mr Anthony Khawaja, consultant ophthalmic surgeon, Moorfields Eye Hospital. Mr Khawaja declared he has a pending honorarium for talking about the role of corneal hysteresis and corneal compensated intraocular pressure in glaucoma management at an optometric congress (100% Optical). The payment will be coming from Grafton Ophthalmics, which distributes ORA G3 in the UK.
- Mr Scott Fraser, consultant ophthalmologist, Sunderland Eye Infirmary. No conflicts of interest declared.
- Mr Simon Longstaff, consultant ophthalmologist, Royal Hallamshire Hospital. No conflicts of interest declared.
- Ms Helen Hobman, senior imaging technician, Hull Royal Infirmary. No conflicts of interest declared.
- Professor David Garway-Heath, honorary consultant ophthalmologist, Moorfields Eye Hospital. Professor Garway-Heath has evaluated ORA G3 as part of a clinical trial and presented the results as a poster at a conference.

Development of this briefing

This briefing was developed by NICE. The interim process and methods statement sets out the process NICE uses to select topics, and how the briefings are developed, quality-assured and approved for publication.

ISBN: 978-1-4731-2975-7