Chapter 4 – VISION ASSESSMENT METHODS

4.1 BASIC VISUAL ASSESSMENT

A standard visual assessment before refractive surgery typically consists of measurement of visual acuity and refractive error, slit lamp examination to assess for ocular surface disease, corneal disorders and an examination to exclude sub-clinical pathology such as glaucoma, cataract and retinal pathology. The ocular examination should also include an assessment of ocular alignment as some ocular motility disorders may become manifest following refractive surgery. Cycloplegic refractions are frequently performed in the pre-operative assessments so that accommodation can be neutralised pharmacologically for more precise testing of refractive status. This is especially beneficial for hyperopic patients.

4.2 ADDITIONAL TESTS OF VISUAL FUNCTION

Detailed tests of visual function can be carried out as part of a refractive surgery assessment or as routine screening for occupational performance capability. The testing may include:

- Colour vision;
- Photopic contrast sensitivity;
- Mesopic contrast sensitivity; and
- Visual fields.

In the event of pathology being suspected from a personal medical or a family history of eye disease, more detailed tests may be indicated. Each of these tests may lead to further diagnostic assessments.

4.3 SPECIAL INVESTIGATIONS

Pachymetry (measurement of corneal thickness) is a mandatory preoperative investigation and can be done by ultrasound or by an optical method. Optical measurement systems are integrated in slit-scanning and Scheimpflug-scanning instruments, which offer the advantage of non-contact-measurements and better reproducibility of local data acquisition.

Corneal Topography is an essential diagnostic tool for preoperative detection of contraindications such as keratoconus or other corneal ectatic disorders which would exclude patients from excimer laser surgery. It is mandatory for all patients before surgery and highly advisable for post-operative evaluation. Commonly used instruments are slit-scanning systems with an additional placido-disc or rotating high resolution CCD-cameras.

Scheimpflug-Based Topographic Systems and split scanning systems compute images of the corneal front and back surface. Maps of corneal curvature, elevation or refractive power can be derived from these data in order to obtain a quantitative analysis of corneal shape.

Keratometry and Placido-Based Keratoscopy are quantitative and qualitative ways of measuring the corneal curvature as a function of its location on the corneal surface. Both methods are incorporated in most modern systems of corneal topography investigation.

Wavefront Measurement Systems, such as the Hartmann-Shack-sensor, the Tscherning-aberrometer or Ray-tracing-systems measure the optical aberrations of the eye for a specified pupil size. They analyse the entire optical characteristics of the eye, not just sphere and cylinder. A wavefront-guided treatment is highly preferable for patients with significant optical aberrations.

Pupil Size has an influence on optical aberrations though wide pupils have not been identified as a definite risk factor for night vision symptoms, such as halo or glare after surgery. It is controversial whether to choose an optical zone based on the preoperative pupil size.

Endothelial-Cell-Counts/Microscopy must be done before and after intraocular refractive surgery, such as phakic intraocular lens implantation or refractive lens exchange. These procedures also necessitate the measurement of anterior chamber depth by ultrasound, Scheimpflug-photography or OCT.

Optical Coherence Tomography (OCT) of the anterior eye computes 3-dimensional reconstructions of cornea, iris, anterior chamber angle and lens through laser interferometry. OCT is no routine investigation. It allows high resolution visualisation of LASIK-flaps or intraocular implants in special cases.

Dry Eye is the most common side-effect after LASIK and may cause reduced visual performance after surgery. The presence of dry eye before surgery should be investigated through a slit lamp exam of the ocular adnexa and cornea. The exam can be augmented with additional tests, such as tear-break-up-time, Schirmer's test or a measurement of tear film osmolarity.

4.4 POST-OPERATIVE VISUAL PERFORMANCE

Military patients, particularly Special Forces and pilots, have greater visual needs than most civilian patients. Subtler visual performance tests can be used to assess their visual status. These can include performing computerised tasks to test dynamic and peripheral contrast sensitivity. For pilots, testing can be extended to flight simulation in order to ensure maximum safety after refractive surgery. Comparison of post-operative visual function test results to pre-operative results may be useful to determine success of surgical outcomes and to guide return to duty decisions [15].