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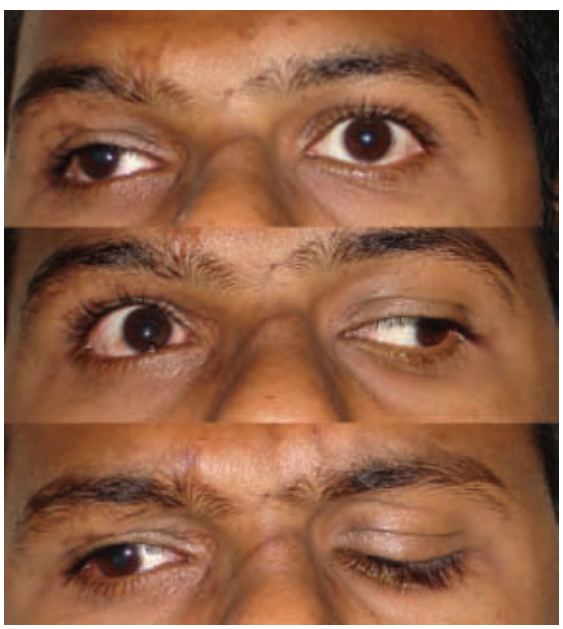

SANKARA NETHRALAYA

Editorial

Dear readers

We wish you all a happy new year. May this year fill with new learning and knowledge. This issue carries a perspective article on intraocular lens implantation in children—a topic in which much debate goes on about the best technique, the best IOL and so on. The accommodative spasm article describes two different presentations and discusses the entity in detail. An intriguing muscle puzzle follows. The continuing series on biostatistics presents yet another chapter. A technology update on the Allegro Biograph concludes the issue.

Dr. S. Meenakshi
Editor
February 2011

Perspective

Intraocular lens implantation in infants

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Early treatment is one of the most important factors in visual outcome in congenital cataract.[1] It has been hypothesized that only visual deprivation is active as an amblyogenic factor during the first few weeks of life, but when unilateral deprivation is prolonged to 12–30 weeks, unequal competition also plays a role in amblyogenesis. The goal of any cataract removal in pediatric patients is to ensure a safe and quiet eye technically, and to provide effective treatment for amblyopia. Currently, three methods are used to correct aphakia in infants: spectacle correction, contact lens (CL) use, and intraocular lens (IOL) implantation. Spectacle correction has been considered as the safest from time immemorial, but it is impractical for infants, especially in unilateral cataracts, because of aniseikonia and anisometropia. CL use is the other method, but it comes with its own disadvantages such as cost, difficulty in handling by the low-socioeconomic class parents, hence poor compliance, and limited visual success. IOL implantation avoids many of these complications, but it is still highly debatable in an infantile eye. The objective of this article is to provide an overview of the common hiccups in IOL implantation in infants with some insight into the existing literature.

Major issues that need to be addressed for IOL implantation in infants include the following:

1. IOL power calculation and refractive goal,
2. type of IOL, and
3. surgical approach.

IOL POWER CALCULATION

Determining the appropriate IOL power for an infant eye poses a unique challenge. Gordon et al. found that major changes in axial length occur in the first two years of life.[2] This makes IOL implantation in infants more unpredictable. Hence, expecting a large myopic shift, there is a need to undercorrect these children so that they can grow into emmetropic or mildly myopic in adult life.[3] The major drawback of this is that the children become hypermetropic and need repeated spectacle change.

The issues to be considered are increase in the axial length and refractive change in the developing eye, and special consideration has to be given to the reliability of IOL formulae in predicting postoperative refraction.

Various IOL power calculation formulae are available at present, and the various studies that indicate as to the one best in children are as follows.

Mezer et al.[4] evaluated refractive outcomes in pediatric patients using five IOL calculation formulae, SRK, SRK II, SRK/T, Hoffer Q, and Holladay, and showed that SRK II showed fair to moderate agreement between the predicted and actual refraction.

Neely et al.[5] analyzed the lens calculation errors predicted by four formulae, SRKII, SRK/T, Hoffer Q, and Holladay, and found that the newer theoretic formula did not outperform the older regression models. SRK II was found to be the least variable.

Nihalani et al.[6] found that Hoffer Q was predictable for the highest number of pediatric eyes and gave equal under- and over-correction unlike other formulae.

REFRACTIVE GOAL

Dahan et al.[3] have made an attempt in their prospective study to categorize children into groups aged less than 2 years and more than 2 years to decide on the IOL power to be implanted. They proposed to undercorrect children in the first group by 20% due to rapid changes in axial length and keratometry compared with those in the second group, and by 10% in the second group.

TYPE OF IOL

Numerous studies have tried to find out the type of IOL that can be implanted into infants' small-sized eye and that which is biocompatible with the eye for life time. Recent evidences support the use of acrylic IOLs.[7,8] One Indian study has shown decreased postoperative inflammation with good results with heparin surface-modified polymethyl methacrylate (PMMA) IOLs.[9] In a comparative evaluation of acrylic and PMMA lenses in pediatric cases, Aasuri et al.[10] reported that the incidence of posterior capsular opacification (PCO) and postoperative uveal inflammation is significantly less with acrylic lenses.

Basti et al.[11] conducted a prospective, randomized, controlled clinical trial and reported a lower incidence of inflammatory cell deposit formation in eyes with heparin surface-modified PMMA IOLs. They concluded that these IOLs have greater biocompatibility than the unmodified IOLs in pediatric cataract surgery.

Nihalani et al.[12] reported that 1-piece AcrySof IOLs provided satisfactory visual axis clarity, produced an acceptable inflammatory response, and maintained centration in pediatric eyes.

SURGICAL APPROACH

The surgical approach to cataract extraction and IOL implantation in younger children requires careful consideration of posterior capsule management. PCO is very common after cataract extraction in children, which can present an amblyogenic hazard.

Therefore, strategies to maintain a clear visual axis are necessary to achieve visual rehabilitation in such cases. Trivedi et al. reported visual axis opacification with AcrySof IOLs in 37.9% of children aged less than 1 year even though a primary posterior capsulotomy (PPC) with anterior vitrectomy had been performed.[13]

Vasavada et al.[18] found that the anterior vitreous face is more reactive in infants and can act as a scaffold not only for lens epithelial cell proliferation, but also for pigment epithelial cells, fibrinous exudates, and cells that result from the breakdown of the blood–aqueous barrier. In their series, opacification of the visual axis was found in 62.5% of the cases where anterior vitrectomy was not performed along with PPC, whereas PPC coupled with anterior vitrectomy ensured that no eye had PCO.

Basti et al.[14] compared three methods for the management of pediatric cataract: lensectomy anterior vitrectomy (LAV), extracapsular cataract extraction with IOL implantation (ECCE + IOL), and ECCE, primary posterior capsulotomy, anterior vitrectomy with IOL (ECCE + PPC + AV + IOL). They concluded that ECCE + PPC + AV + IOL was conducive to at least short-term maintenance of a clear visual axis, provided optimum refractive correction, and was not associated with increased risk of short-term complications.

STUDIES WITH GOOD OUTCOME WITH PRIMARY IOL IMPLANTATION

Knight-Nanan et al. found that all the seven eyes of congenital cataract operated between one and 22 months of age had central steady and maintained fixation postoperatively.[15]

Hutchinson et al. noticed central steady and maintained fixation or better vision in 49.5% of the eyes in children aged less than 24 months, where cataract extraction with primary IOL implantation was done.[16]

Good visual outcome was achieved with primary IOL implantation in all but three cases in a case series by Ram et al.[9]

Carefully and meticulously performed primary IOL implantation appears to be a safe and effective method for aphakic correction in children aged less than 2 years. PPC and anterior vitrectomy reduce the rate of secondary opacification of the visual axis in a pseudophakic eye.

Infant aphakia treatment study[17]

Lambert et al. (Infant Aphakia Treatment Study Group) performed a randomized, multicenter (12 sites) clinical trial in infants with unilateral congenital cataract, assigned to undergo cataract surgery between 1 and 6 months of age, either with or without primary IOL implantation. CLs were used to correct aphakia in patients who did not receive IOLs. No statistically significant difference was found in grating visual acuity at 1 year of age between IOL and CL groups; however, additional intraocular operations were performed more frequently in the IOL group.

The study thus alerts the pediatric ophthalmologists to exercise caution when performing IOL implantation in children aged 6 months or younger, given the higher incidence of adverse events and the absence of an improved short-term visual outcome compared with CL use.

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Accommodative spasm

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INTRODUCTION

Accommodation is a unique mechanism by which the eye can focus the diverging rays coming from the near object onto the retina. There is a change in dioptric power of the crystalline lens, thereby altering the focus of the eye. It is controlled by the parasympathetic nervous system. The primary stimuli are a blurred retinal image, apparent size, and distance of the object.

Anomalies of accommodations are classified as follows:

Increased accommodation: (1) accommodation spasm.

Decreased accommodation: (1) physiological – presbyopia and (2) pathological: (i) accommodative insufficiency; (ii) ill-sustained accommodation; (iii) paralysis of accommodation; and (iv) accommodative infacility.

Accommodative spasm (AS) is a rare condition occurring in children, in which the accommodative response exceeds accommodative stimulus and the patients have difficulty with all tasks requiring relaxation of accommodation because of over-excitable and irritable state of ciliary muscle.

It occurs in less than 3% of patients with accommodative disorders.[1] It may begin suddenly, mostly bilateral (can be unilateral[2]), and associated with miosis and convergence spasm. It can be seen as a physiological adaptation in young hypermetrope; can occur in myope, in astigmatic errors or in presbyopes; can occur in unstable or neurotic or can be accentuated by excessive near work and dim/excessive illumination.

AS can be caused by head trauma or emotional problems[3,4,6]. It occurs sporadically, and rarely familial cases have been reported.[5] Drugs such as cholinergics—pilocarpine, morphine, digitalis, sulfonamides, and CAI, and organic conditions such as encephalitis, syphilis, influenza, meningitis, trigeminal neuralgia, and iritis may be associated with AS.

This presentation documents two patients who presented to us with similar complaints and were diagnosed as having AS.

CASE REPORTS

Case 1

History

A 9-year-old female, fourth standard student, resident of Madhya Pradesh, was referred to us on 12 October 2010 with the chief complaints of double vision in both eyes since 2 months, recurrent attacks of eyestrain and blurred vision in both eyes while doing near work since 2 months. The binocular diplopia was present in all gazes, continuous and gradually worsening since 2 months. She also gave a history of right eye squinting inside occasionally since 3–4 days.

Past ocular history

The patient's prior ocular and medical histories were unremarkable. She denied having any recent illness and headaches, or taking any medications. There was a history of trivial trauma to the left eyebrow 2 months back (14 August 2010). There was no history of similar complaints or squinting in the family members.

As noted by the local practitioner, the visual acuity was ranging from 6/6,N6 in both eyes to counting fingers at 2 m in both eyes with a varying reflex on retinoscopy. MRI brain (8 September 2010) was advised, which was unremarkable.

Our examination

Eye examination revealed visual acuities of counting fingers 1 m N18 in both the eyes. On retinoscopy, a varying reflex of −8.50 DS in the right eye and −9.50 DS in the left eye with subjective improvement of her visual acuity, 6/36,N10, in both the eyes was noted. Pupillary examination was normal.

Ocular motility examination

She was orthophoric on Hirschberg, but small amount of right esotropia was noted at a distance (4PD BO) and near (6PD BO) on cover test.

Sensory tests

Stereopsis at near was 3000 arcsec. Worth 4-dot test showed fusion. Anterior and posterior segment evaluations were unremarkable.

Diagnosis and plan

The diagnosis of AS with right esotropia was made, and the patient was advised atropine refraction after 3 days of application of atropine ointment 1% at night in both eyes. Atropine side effects were explained. Cycloplegic retinoscopy was OU +1.50DS/−0.5 DC at 180. Patient's visual acuity with plano was OU 6/9. Thus, AS was confirmed and no further extensive neurological testing was advised. Atropine eye drop 1% was prescribed once daily with punctual occlusion for 1 month, and bifocals with

photochromic lenses were given. She was asked to review after 1 month.

Case 2

History

A 10-year-old female, fifth standard student, resident of Lakhnau, presented to us on 14 October 2010 with the chief complaints of diminution vision in both eyes since 8 months which was painless and gradually worsening. She gave a history of recurrent attacks of headache, eye-strain, and blurring in both eyes while doing near work. There was no history of squinting of the eyes.

Past history

The patient's prior ocular and medical histories were unremarkable. She denied having any recent illness, trauma, and headaches, or taking any medications. There was a family history of heredomacular degeneration, and her mother was highly myopic. She gave a history of varying spectacle power when checked by the local practitioner, and was referred here for further management.

Ocular examination

The examination revealed visual acuities of 3/60,N6 at 10 cm in both the eyes. On retinoscopy, we got a varying reflex of -4.50 DS in the right eye and -4.00 DS in the left eye. Her visual acuity was OD 6/18,N6 and 6/9,N6 with the acceptance of OD -4.00 DS and OS -3.50 DS. Cycloplegic retinoscopy was OU $+0.75$ DS. The patient's visual acuity with plano was OU 6/6. Pupillary functions were normal.

Ocular motility

She was orthophoric on Hirschberg, but small amount of right esotropia for near (6PD BO) was noted on cover test.

Sensory tests

Stereopsis at near was 70 arcsec. Worth 4-dot test showed fusion.

Near point of accommodation was 8 cm OU and near point of convergence was 6 cm. Anterior and posterior segment evaluations were unremarkable. As there was a strong family history of heredomacular degeneration, ERG and Mf ERG were advised, which were within normal limits. Thus, AS was confirmed and no further extensive neurological tests were advised. Atropine eye drop 1% was prescribed once daily with punctual occlusion for 1 month, and bifocals with photochromic lenses were given. She was asked to review after 1 month.

DISCUSSION

These case reports demonstrate the similar presentation of AS in different scenarios. Both the children manifested AS with convergent squint without pupillary constriction.

The etiology of AS has been associated with diverse organic causes including closed head trauma[3,4,6], multiple sclerosis, intracranial hypertension, LASIK, and ocular or systemic pharmacological agents.

In the case of the first patient, there was a history of trauma after which the patient developed AS. We hypothesized that this trauma can be a triggering factor for AS. Paul Chan et al.[6] described six cases of post-traumatic AS which did not manifest into miosis or esotropia. Some lesions may interfere with inhibition of accommodative portion of parasympathetic (Edinger- Westphal) subnucleus of the third nerve.

We could not explain the cause of AS in the second case. Family history of heredomacular degeneration was an accidental finding. Although AS occurs sporadically, familial cases had been reported by Rutstein et al.[5]

AS, accommodative excess, pseudomyopia or ciliary spasm is usually a self-limiting condition, in which there is an involuntary tendency to maintain accommodation in the absence of a dioptric stimulus.[1] Patients present with blurred vision depending on their refractive status, macropsia, asthenopia during close work, pain (brows/headache), poor concentration, miosis, and convergence anomalies (excess or insufficiency).[7]

The following are clinical signs as reported by Scheiman and Wick[7]:

1. Normal amplitudes of accommodation.
2. Difficulty clearing plus lenses with both monocular and binocular accommodative facility testing.
3. Reduced negative relative accommodation findings (normal$=+2.00\pm0.50)\times20$.
4. Low lag of accommodation as determined by MEM retinoscopy or the fused cross cylinder test. A lead of accommodation is often determined.
5. Low base-in to blur finding at near.

Although non-organic AS can resolve spontaneously over time, treatment is usually indicated because of severe symptoms. It can be treated by relaxation of ciliary muscles with atropine and optical correction by prescribing bifocals.

Presently, both the patients are using atropine drops one per day with bifocals. The goal is to wean entirely from the drops and bifocals and not have the AS recur.

In summary, every case of AS should receive a detailed eye examination including cycloplegic refraction with emphasis on recognizing AS.

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Muscle Puzzle

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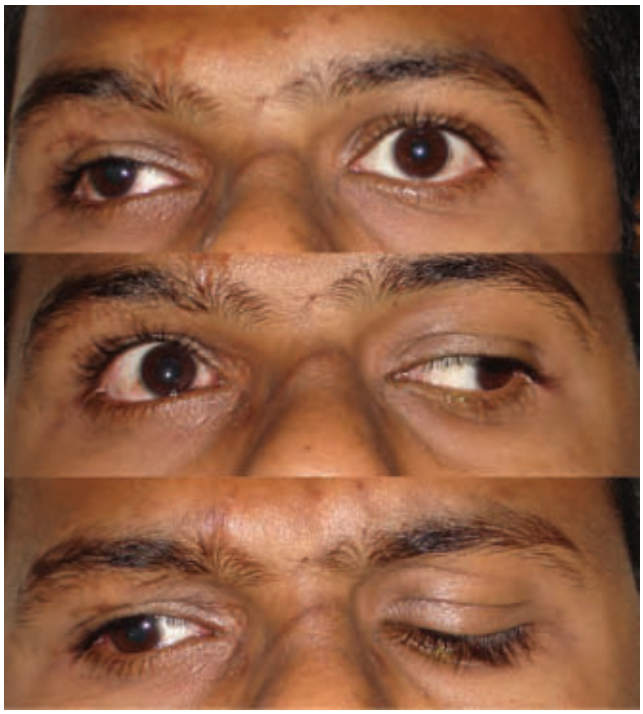
A 26-year-old male came to us with complaints of double vision in primary and right gaze on 13 October 2010. He also had complaints of mild drooping of right upper eyelid and deviation of right eyeball outwards since 10 months following a road traffic accident. He had undergone orbital floor reconstructive surgery. On examination, his unaided VA was 6/6,N10 and 6/5,N6 in his right and left eyes, respectively. His clinical photos are shown here.



WHAT IS YOUR DIAGNOSIS?

Answer available at page 11.

Introduction to Biostatistics-7

Part II. Inferential Statistics

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In the previous issue, we dealt with various basic concepts or terminologies that are commonly used in inferential statistics. In this article, we are going to discuss the various statistical tools used for testing of hypothesis.

In any study, null hypothesis is tested for possible rejections under the assumptions that it is true using appropriate statistical tests such as Chi-square, *t*-test, ANOVA, etc. The type of tests used is based on the following three important criteria: type of data (qualitative or quantitative data), normality of data, and size of the sample.

The commonly used various statistical tests are as follows.

Chi-square test (pronounced "kye-square") is a measure used to determine whether a relationship exists between two categorical variables. This test uses frequencies instead of mean and variances.

Data used in a Chi-square analysis have to satisfy the following conditions:

1. randomly drawn from the population;
2. the data must be reported in raw counts or frequency;
3. they should be independent and mutually exclusive;
4. the expected frequency in any one cell of the table must be greater than 5; and
5. the total number of observations must be greater than 20.

There are two types of Chi-square tests:

The Chi-square test for goodness of fit: This is a test of the agreement between a hypothetical and a sample distribution. A number of times, we find that the results obtained in samples are not consistent with the theoretical results expected according to the rules of probability, and thus, Chi-square compares the expected and observed values to determine how well an experimenter's predictions fit the data.

Example: For pain following buckle surgery, Inj. Ketorolac is commonly administered to patients as intramuscular injection. Now, Chi-square test for goodness of fit can be used to determine whether the pain is reduced in a significant number of patients with this Ketorolac injection.

The Chi-square test for independence of attributes. The population and sample are now classified according to several attributes, but the probability distributions of the classifications are not given. In such cases, we are interested in ascertaining whether there is any dependency relationship between the two attributes. When we apply the Chi-square distribution, it will indicate whether or not the two attributes are independent. The test cannot indicate the degree of association or the direction of dependency.

Example: Chi-square test for independence of attributes can be used to determine whether smoking is associated with lung cancer or not.

FISHER'S EXACT TEST

It is the test for independence of attributes in a 2×2 table. It is most useful when the total sample size is small and the expected value in any one of the cell is less than 5. It is used to examine the significance of the association between two kinds of qualitative variables.

Example: A sample of teenagers might be divided into male and female, on the one hand, and those that are and are not currently dieting, on the other. The data collected are shown in Table 1.

Now, to test whether the proportion of dieting individuals is higher among the women than among the men, Fisher's exact test must be used. In the above example, Chi-square test cannot be used, since the observed frequency in the first and last cells is less than 5.

McNEMAR'S TEST

It is a non-parametric method used for nominal data. It is applied to 2×2 contingency table with a dichotomous trait, with matched pairs of subjects. It can be used to determine whether the row and column marginal frequencies are equal.

Example: A researcher wants to determine whether a newly developed drug has an effect on a particular disease. Counts of individuals are given in Table 2, with the diagnosis (disease: present or absent) before treatment given in the rows, and the diagnosis after treatment given in the columns.

Now for the above example, McNemar's test should be used to determine the effectiveness of the drug.

The *t*-test was invented by William Sealy Gosset, who wrote under the pseudonym "student".

The different types of *t*-tests are as follows.

One-sample t-test: It is a statistical procedure that is used to know the mean difference between the sample and the known value of the population mean. We draw a random sample from the population and then compare the sample mean with the population mean and make a statistical decision as to whether or not the sample mean is different from the population mean.

Table 1. Contingency table of men and women for dietary habits.

	Men	Women	Total
Dieting	1	9	10
Not dieting	11	3	14
Total	12	12	24

Table 2. The results of the study for effectiveness of drugs.

	After treatment		Total
Before treatment	Present	Absent	
Present	101	121	222
Absent	59	33	92
Total	160	154	314

Example: One-sample *t*-test can be used to determine whether individuals with short thick neck have intraocular pressure more than the normal pressure limits.

Assumptions in the one-sample *t*-test are as follows:

Variables should be normally distributed.

Samples drawn from the population should be random.

Cases of sample must be independent.

In one-sample *t*-test, we should know the population mean.

Sample size should be less than 30.

Two-sample t-tests – independent and dependent *t*-tests:

Independent *t*-test: It is used to find out whether there is any significant difference between two uncorrelated samples.

Example: Let us assume that drugs A and B are the newly developed anti-hypertensive drugs. Now, two-sample *t*-tests can be used to determine whether there is any significant effect between them in reducing the blood pressure level.

Assumptions in the two-sample *t*-test are as follows:

Variables should be normally distributed.

Samples should be randomly drawn from the population.

Variances between the two samples should be equal.

Two samples should be independent.

Data should be interval or ratio scale.

Dependent *t*-test: It is used to find out whether there is any significant difference between two correlated (paired) samples. It is generally used when measurements are taken from the same subject before and after some manipulation, such as injection of a drug.

Example: Paired-test can be used to determine whether there is any significant difference in the blood pressure before and after administration of phenylephrine (dilatation) eye drops for children posted for examination under general anaesthesia.

Assumptions in the dependent *t*-test are as follows:

The distribution of the differences should be normally distributed.

Two samples should be of equal size.

The samples should be dependent and it should be possible to identify specific pairs.

Variances between the samples should be equal.

ANOVA (ANalysis Of VAriance):

It is a statistical tool that can be used to test the hypothesis that the means of more than two groups are equal, under the assumption that the sampled populations are normally distributed.

Assumptions in ANOVA are as follows:

The data should be continuous, interval type.

The samples must be independent of each other.

The sample should be drawn from a normally distributed population.

Variances among the groups must be equal.

TYPES OF ANOVA

One-way ANOVA

One-way ANOVA is used to test the equality of three or more means at one time by using variances. Here, only one factor will be analysed.

Example: To study the onset of action of local anaesthetic solution at different pH values, say 7.2, 7.4 and 7.6, one-way ANOVA can be used to find out whether there is any significant difference in the mean time of onset of action among the three groups.

Two-way ANOVA

The two-way ANOVA is an extension to the one-way ANOVA, by which one can analyse two independent variables (hence the name two-way) or factors.

Example: In the above example, apart from the pH value (first independent variable), if the researcher wants to determine whether the size of the orbit (second independent variable) also influences the onset of action of local anaesthetic solution, then two-way ANOVA can be used.

CONCLUSION

Thus, in this issue, we have discussed the commonly used various statistical tools. To obtain valid results, one has to know the assumptions of each and every test, so that the appropriate tool is used in the study.

In the next issue, we will discuss the non-parametric tests and their importance.

An overview of statistical tool.

Type of data	Number of variables	Normality	Independence/ dependence	Statistical tools
Quantitative	1	Normal	Not required	One-sample *t*-test
	2	Normal	Independent	Independent sample *t*-test
		Normal	Dependent	Paired *t*-test
	More than 2	Normal	Independent	ANOVA
Qualitative	2	Not required	Independent	Chi-square test
		Not required	Dependent	McNemar's test

Technology Update: Allegro Biograph

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Today cataract surgery is being performed in patients who have less visual disability than several years ago. Patients have come to view cataract surgery as both a rehabilitative and a refractive procedure. This expectation places increased importance on accurate biometry and intraocular lens (IOL) calculation. While ultrasound axial length measurements have been the gold standard for a long time, the introduction of partial coherence interferometry-based biometry was a big step towards measurements that were more precise and reliable.[1] Since the advent of the first commercial device in 2001 (IOLMaster, Carl Zeiss), this has become the technique of choice for ocular biometry. WaveLight AG (Erlangen, Germany) introduced the Allegro Biograph, a combined biometer for cataract and refractive surgeries, in 2008.

THE ALLEGRO BIOGRAPH

It is based on the innovative optical low-coherence reflectometry (OCLR) principle. The technique was developed in the late 1980s for reflection measurement in telecommunication devices, and was first applied *in vivo* by Fercher and colleagues. This Biograph uses a partially coherent infrared light beam of 820 nm diode laser. The laser beam is split up into two beams in a Michelson interferometer (reference and measurement beams). Both beams are projected into the eye and get reflected at the cornea and retina. The signals are amplified, filtered, and recorded as a function of the position of the interferometer mirror.

The Allegro BioGraph is a multifunctional biometry device used to analyse the complete anterior segment of the eye with just a single click, known as the EyeClick technology. A total of 16 consecutive scans are taken for each measurement. A traffic light principle [red (low signal), yellow (medium signal), and green (high signal)] is used to simplify and secure the alignment and start the measurement. Automatic measurement plotting (a growing circle in the clockwise direction) helps to follow the measurement process. The Biograph measures the axial length, anterior chamber depth, and thickness of the cornea, lens, and retina. Additionally, it simultaneously determines the radius of the corneal curvature, white-to-white distance, pupil diameter, and location of the visual-optical line.

APPLICATIONS

1. IOL power calculation

- Precision of axial length measurement up to ± 0.02 mm.
- Includes all internationally established IOL power calculation formulas.
- Accuracy in IOL calculation up to 0.01 D.
- Gives white-to-white measurement used in third- and fourth-generation IOL formulas.
- The integrated conversion factor enables the usage of all the established IOL calculation formulas originally derived from ultrasound biometry.
- All outcomes from the different IOL power calculations and IOL models are presented at a glance.

2. Refractive surgery

- Screening and monitoring for laser ablative refractive procedures by central corneal thickness.
- Gives the anatomic anterior chamber depth for precise customization of phakic IOLs.

3. Disease monitoring

- Central corneal thickness and anterior chamber depth for glaucoma.
- Retinal thickness for monitoring age-related macular degeneration.

Advantages

- Even suitable for eyes that are highly myopic, aphakic, or filled with silicone oil.
- Accuracy not operator-dependent, unlike ultrasound.
- Space-saving multifunctional design.

- Non-contact instrument—no need for anesthesia, and minimized risk of potential corneal infections and injuries.
- Easy to use and time-saving measurement with swift calculations.
- Short lapses in patients' ability to remain focused do not negate the overall measurement.
- Accurate measurements even in cataractous eyes by use of superluminescent diode (SLD).

COMPARISON WITH IOL MASTER

The Biograph provides results that correlate very well with those provided by the IOLMaster according to various studies.[3–5]

Thus, the Allegro Biograph is a precise device containing additional features that will be a helpful tool for any cataract or refractive surgeon.

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ANSWER FOR MUSCLE PUZZLE

Answer: Aberrant regeneration of the third cranial nerve.

Aberrant regeneration of the third cranial nerve is a condition that occurs when there is partial recovery of the nerve after suffering an insult. Oculomotor synkinesis becomes apparent within 9 weeks of injury, but it is variable from 3 to 6 months. Incidence of aberrant regeneration of the third nerve after acute third nerve injury is 15%.

Oculomotor synkinesis can be primary or secondary.

Oculomotor nerve synkinesis can occur as a primary phenomenon without a pre-existing paresis as in slow-growing lesions of cavernous sinus. Oculomotor synkinesis occurring after an acquired or congenital oculomotor palsy is secondary synkinesis. Head trauma and posterior communicating artery aneurysm are the most common causes for this condition. Aberrant regenerations occur when the nerve fibres subserving one muscle group get connected to some other muscle group. Thus, superior rectus fibres may get connected to medial rectus fibres resulting in adduction when the eyes are elevated, or inferior rectus fibres get connected to elevator palpebrae superioris causing a lid retraction in downgaze.

Ephaptic transmission and central synaptic reorganization are the proposed mechanisms for synkinesis. Ephaptic activation of axons can occur centrally within a partially demyelinated lesion or peripherally at the compressed or severed segment of a nerve. An ephapse develops where adjacent nerve fibres are injured. Another theory says that structural alteration in the oculomotor subnuclei rather than in the peripheral neurons is responsible for the synkinesis. Chromatolysis that is initiated by the injury induces structural, metabolic, and physiological alterations in the nerve cell body. Thus, anomalous co-contraction might occur because after axonal injury, central brain stem neurons at the level of oculomotor subnuclei undergo synaptic reorganization.

The signs of aberrant regeneration of the third nerve are the following:

(1) horizontal gaze–eyelid synkinesis—elevation of the involved eyelid in attempted adduction of the eye;
(2) pseudo-Graefe sign—retraction and elevation of the eyelid on attempted downgaze;
(3) pseudo-argyll Robertson pupil—the involved pupil does not react or reacts poorly to light, but the pupil constricts during adduction on conjugate gazes; and
(4) suppression of mono-ocular vertical optokinetic responses.

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