

Study of Intra Ocular Pressure Changes after Isometric Handgrip Exercise Test in Young Adults

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Abstract

Objective: To Study the effect of isometric handgrip exercise test on Intra ocular pressure in young adults

Method: Healthy young male adults in the age group of 18-22 years were selected among MBBS phase I students of a Medical college. Sample size was 40. Heart rate and IOP were recorded at rest and after isometric handgrip test

Results: Right eye IOP has decreased significantly from resting 16.28 ± 1.55 to 9.30 ± 1.79 ($p < 0.001$) immediately after handgrip exercise. Left eye IOP has decreased significantly from resting 16.15 ± 1.69 to 13.04 ± 1.19 ($p < 0.001$) immediately after handgrip exercise. IOP

Conclusion: Isometric handgrip exercise lowers IOP which were significant. Hence may prove useful in normotensive glaucomatous patients

Key words: Intraocular pressure, Handgrip dynamometer

Introduction

The Intra Ocular Pressure¹ (IOP) is important in maintaining shape of the eye ball and optical integrity. IOP is known to be sensitive to many physiological variables in the body system which include age, sex, body position, valsalva manoeuvre, exercise, diurnal variations and pregnancy.

Exercise when performed regularly has beneficial effect on various systems of individual like physical, metabolic, and psychological. These physiological variables in body system include changes in vascular

pressure, serum osmolarity, hormonal levels, decrease in blood pH, increase in blood lactate and presence of toxins.

It is well documented that improvement of physical fitness through regular exercise can produce physiological change in the whole body especially in the cardiovascular system.

In recent years it has been documented that IOP is a dynamic function and is subjected to many influences both acutely and over long term. IOP is also known to be responsive to short-term and long-term exercise.

Glaucoma is chronic progressive optic neuropathy caused by a group of ocular conditions which lead to damage to optic nerve with loss of visual function. Most common risk factor is raised intraocular

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pressure^(1,4,5) Relationship between isokinetic exercise & IOP showed significant lowering of IOP after exercise^(2,3)

Aims & Objective

To Study the effect of isometric handgrip exercise test on Intra ocular pressure in young adults

Materials and Methods

Healthy young male adults in the age group of 18-22 years with BMI of 18-22.9kg/m² were selected among MBBS phase I students of a Medical college. Sample size was 40. Heart rate and IOP were recorded at rest and after isometric handgrip test.

The subjects were requested to complete a questionnaire that included inclusion and exclusion criterias. Then physical examination was carried on each participant to rule out any systemic diseases affecting IOP. The weight, height, were measured and BMI was calculated by using formula weight in kgs / the square of height in meter. Subjects fitting the inclusion and exclusion criterias (n =40) were considered for the study. Overweight subjects (BMI-23-24.9 kg/ m²) and subjects with refractive errors were excluded.

Inclusion Criteria

- v Young healthy adults in the age group of 18-21yrs of both sexes.
- v Non obese BMI 18 – 22.9 kg/ m².
- v Normotensive < 130/80mm Hg.
- v Non smoker
- v Non alcoholic

Subjects with Pre-existing refractive error, acute and chronic Conjunctivitis, Glaucoma, Migraine were excluded from study⁽⁷⁾

Materials:

- Power lab ECG.
- Schiottz tonometer
- Handgripdynamometer

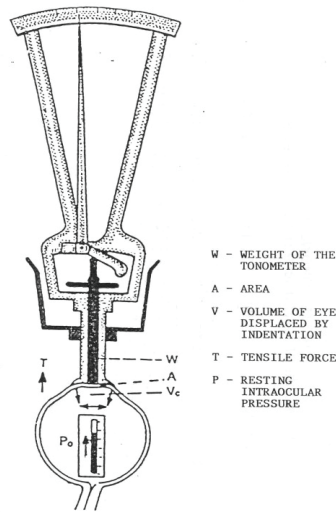
AD Instrument Powerlab (Model-ML870, Serial-830-0732):

AD Instruments provides computer-based data acquisition systems for research and education. Powerlab data acquisition systems and choice of LabChart, LabTutor and LabAuthor software, provide outstanding data acquisition, display, analysis and authoring features for a wide range of life science applications. Since 1988, Powerlab (also MacLab) systems have been used for data acquisition and analysis by the world's best academic, government and private organizations. Powerlab systems combine software-controlled input of parameters, extensive signal conditioning options, variable sampling speeds and powerful real-time computations with the advantages of computer-based data display and analysis. They offer the functionality of a chart recorder, XYT plotter, digital voltmeter and storage oscilloscope in one compact unit. LabChart software, supplied with Powerlab systems helps in analysing the data. In the present study by using Powerlab Heart rate measurement was done on subjects in supine posture.

Basic concept and theory of indentation:

Schiottz tonometry is based on the fundamental fact that a plunger will indent a soft eye more than a hard eye. When the tonometer is placed on the cornea, immediately the different forces come into play; W- the Weight of the tonometer, acts over an area A and indents the cornea displacing a volume V. The tensile force T set up in the outer coats of the eye at every where tangentially to the corneal surface, with a component opposing W, so that an additional force

T is added to the original baseline or resting IOP (P₀) which is artificially raised to a new value (. Thus the scale reading of the tonometer actually measures the artificially raised IOP



Hand grip dynamometer :

The device used to measure the grip strength is called dynamometer. It is reliable and valid in evaluation of grip strength. It is widely accepted and grip strength measurements provide an objective index of the functional integrity of the upper extremity. Measurement of grip strength by hand dynamometry is reproducible and consistent. The handgrip dynamometer is easy to handle and reliable in its measurements.

Parameters

Study was carried out in physiology department

- Intraocular pressure in mm hg in supine position using standard steps.
- Weight in kilogram. & Height in meters were

measured. BMI=Weight in kg/height in meter² was calculated to group them as normal weight.

- Heart rate
- Maximum voluntary contractions(MVC) was assessed and subjects were asked to carry out endurance isometric exercise at 40% of their MVC

Study method –

Prospective study.

Ethical clearance was obtained from our institution Ethical committee

Prior to the procedure written and informed consent was obtained from all the subjects..

The exercise was performed in a well-ventilated room. Participants were instructed not to consume beverages nor a heavy meal in previous 4hours or participate in any vigorous activities 24 hour before test

Isometric endurance contraction at 40% of the individuals MVC was executed with handgripdynamometer

In order to minimize the bias of diurnal variations of IOP and other parameters, the studies were made between 3pm to 4pm.

At the reporting time subjects were asked to relax in supine position for 5min. Baseline IOP was recorded .Subjects executed MVC contractions of 1second duration at 1 minute interval for 3times .Maximum of these is considered as their MVC .Then endurance contraction at 40% of their MVC is made. Intraocular pressure and Heart rate were measured in supine position immediately (within 30 sec), at five, at ten, at fifteen minutes after exercise.

Statistical Analysis

Mean and Standard deviation was calculated for

isometric hand grip exercise test in young adults. Paired t-test was applied at 5% level to test the significance of changes in above parameters(Using Epi-Info) Microsoft Excel and EPI-INFO package were used for data entry and statistical analyses respectively.

Results

Mean and SD of IOP of right & left eye after Isometric handgrip Exercise

Parameter	Duration	Hand Grip	P value
Right eye IOP	Resting	16.28±1.55	>0.05
	1 min exercise	9.30±1.79	<0.001*
	5 min postexercise	10.67± 1.90	<0.001*
	10 min postexercise	13.99±1.32	<0.001*
	15 min pt exercise	16.26±1.57	>0.05
Left eye IOP	Resting	16.15±1.70	>0.05
	1 min exercise	8.91±1.74	<0.001*
	5 min postexercise	10.60±1.92	<0.001*
	10 min postexercise	13.74± 1.71	<0.001*
	15 min pt exercise	16.15±1.69	>0.05

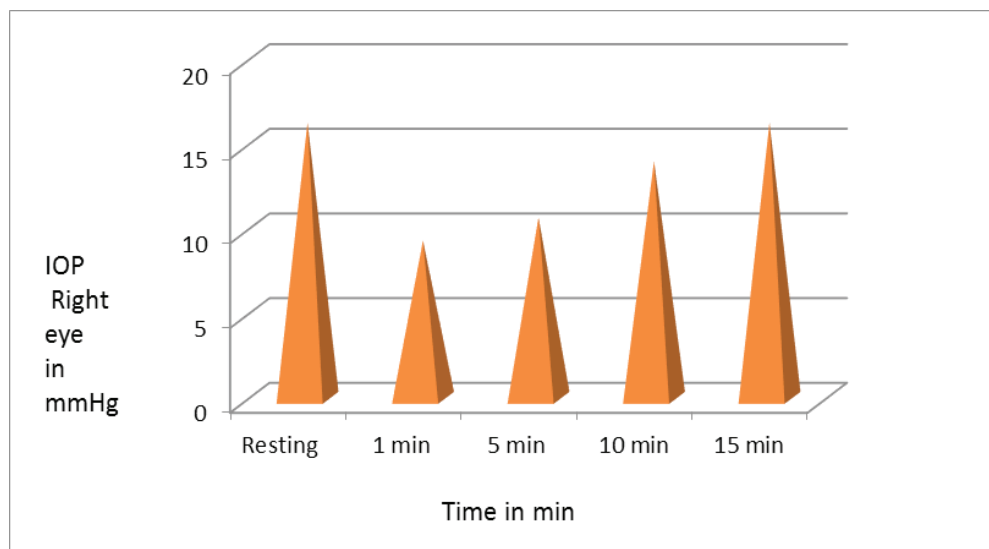
Data presented as mean & SD

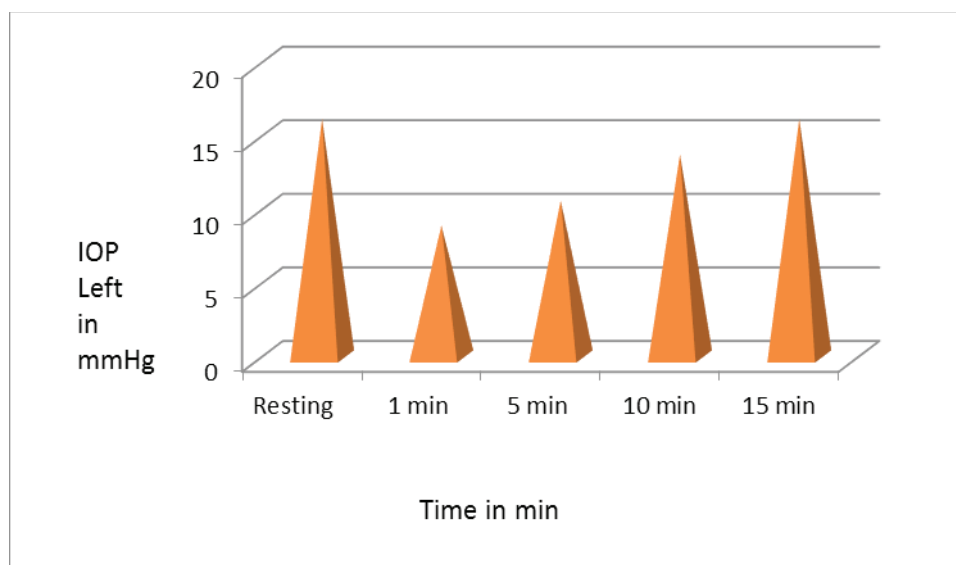
*Statistically significant $p < 0.05$

Right eye IOP has decreased significantly from resting 16.28±1.55 to 9.30±1.79 ($p < 0.001$) immediately after handgrip exercise IOP has returned

back to resting level within 15 min after exercise.

Left eye IOP has decreased significantly from resting 16.15±1.69 to 13.04±1.19 ($p < 0.001$) immediately after handgrip exercise IOP has returned back to resting level within 15 min after exercise.





Discussion

- Isometric handgrip exercise stimulates the ocular sympathetic nervous system to increase the facility of outflow and thus decreases IOP. Also, epinephrine stimulates the synthesis of cAMP. Activation of cAMP decreases IOP by decreasing aqueous humor production^(6,8)

- Also, after handgrip exercise, there is a rise in blood lactate levels. Increased lactate levels cause the outflux of water from the eye, which is responsible for a fall in IOP⁽⁹⁾

- Low CO₂ tension in blood is associated with a reduction of IOP after isometric (anaerobic) exercise. In his study, Harris compared the drop in IOP in two sets of individuals. In the first set, subjects were made isocapnic during exercise by giving carbon dioxide, and in the second set, subjects were not given carbon dioxide and thus stayed hypocapnic. They observed cessation in IOP drop with blockage of exercise-induced hypocapnia in the first set and claimed the presence of this indirect effect of exercise of reduction in IOP by inducing hypocapnia⁽¹⁰⁾

Conclusion

Isometric handgrip exercise induces a rise in heart rate and simultaneously lowers IOP, and both were significant. Hence, it may prove useful in normotensive glaucomatous patients.

Conflict of Interest : None

Source of Funding : Self

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