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Brief communication

Non-pharmacological therapies for primary open angle glaucoma: A quasi-experimental pilot study

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Abstract

Purpose: One of the major causes of blindness is Primary open angle glaucoma (POAG) and it has only surgical treatment and lifelong use of medication. Hence many side effects arise. To overcome this, the drugless approach is in practice but the importance of Muscle Energy Technique (MET) and Myofacial (MFR) Release is not explored. Hence, our objective was to determine the effectiveness of MET and MFR on POAG.
Methods: A total of 12 patients with POAG were recruited from the tertiary care teaching hospital through criteria based convenience sampling for the study. But nine patients with POAG completed the study. The age of the patient with POAG ranges from 15 to 30 years. MET and MFR were given to the patient for 30 min/day, six days/week for three weeks. Intraocular pressure (IOP) was assessed with Tonometer as dependent variable by Ophthalmologist. Pre and post treatment IOP change was established.
Result: Pre IOP and Post are 23.1 ± 1.9 mmHg and Post IOP is 20 ± 1.4 mmHg respectively. The mean pre-post difference is 3.1 ± 1.9 mmHg with significance difference of $p = 0.002$.
Conclusion: MET and MFR reduce IOP. This proves to be one of the feasible and cost effective treatments in the management of POAG.
Clinical Trial Registry: CTRI/2014/09/4986

Keywords: Eyes, Glaucoma, Muscle energy technique, Myofacial release, Physiotherapy, Intra ocular pressure, Rehabilitation

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Introduction

One of the leading causes of blindness in human is glaucoma which becomes a considerable socioeconomic challenge.[1] Glaucoma needs lifelong medication to prevent irreversible damage which is caused by raised intra ocular pressure and in children it affects their activity of daily living.[2] Increased intraocular pressure (IOP) due to obstructed aqueous humor outflow is the most important risk factor for the glaucoma.[1,3] The Open-angle glaucoma is the commonest type glaucoma, which often remains unnoticed by the patient for a long time as the eye pressure rises slowly to 20–30 mmHg. Normally IOP lies between 10.5 and 18 mmHg.[2] Travel describes the development of ocular hypertension in case of a dysbalance of the occipital muscle.[4] It means the elevation of IOP is due to extra-ocular muscle contraction. Almost 10 mmHg of IOP can be resulted from normal blink, whereas orbicularis-oculi muscle's powerful contraction can raise IOP to >50 mmHg.[5] This increased IOP may result from the depolarization of succinylcholine raises IOP by the contraction of the extra-ocular muscles.[6]

For a long time elevated IOP was considered the main cause for the development of glaucoma and it is one of many other risk factors.[7] The reduction in each 1 mmHg of IOP lowers the progression of the risk of disease by approximately 10%. Sutherland considered glaucoma an obstruction to

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the outflow of venous due to cranial membranous lesion. Therefore osteopathic techniques are used for improving the circulation in the eye and for the drainage of aqueous humor. From physiotherapy point of view, IOP raise is due to autonomic dysfunction, osseous dysfunction and muscular dysfunction. Not only vascular dysfunctions (e.g. congestion in inferior ophthalmic vein in the pterygoid plexus) are mentioned but also osseous dysfunctions such as constriction of the superior and inferior orbital fissure that causes a congestion of the superior ophthalmic vein are described. In this context particularly good mobility in the skull base area and the seven bones of the orbit appear to be crucial. Furthermore it is recommended to examine the sphenopetrosal suture, the occipitomastoid suture and the lacrimal bone, as their flexibility is of great importance for a functional drainage of venous congestions in the head region. An imbalance in the ocular muscles tone can cause a movement dysfunction at the sphenoid bone, at the maxilla and at the ocular muscle nerves.[4]

The medical management of chronic glaucoma by eye drops is still the most common therapy which aimed in lowering IOP. At present days a variety classes of medications are available, which acts either by decreasing aqueous humor production or by increasing the aqueous humor outflow into the trabecular meshwork. If the eye drops are not suitable for the patient or its effects on the raised IOP are not satisfactory then only the treatment is provided by means of surgerys.[2] Other complementary treatments are Homeopathic remedies, Physiotherapy, Yoga, and Osteopathy.[8]

'Muscle energy technique (MET) is a series of muscle energy techniques designed to balance extra-ocular muscle tone. These techniques utilize traditional muscle energy principles with the physiotherapist applying resistance against the ocular globe as the patient attempts to look in a specific direction.[9,10] Other benefits of MET are emotional relief, relaxation or general feelings of well-being. Another valuable technique is myofascial release (MFR) which is the release of muscles and fascia. It normalizes the tone and relaxes the muscle which leads to lowering of IOP.[11] MET and MFR are not new techniques but the application of all the techniques simultaneously might have beneficial effect in the eye. The effectiveness of MET and MFR in the patient with POAG are explored in this study.

Methods

Patient recruitment

This study protocol has received the ethical clearance from the ethical committee of Maharishi Markandeshwar institute of Physiotherapy and rehabilitation, Mullana-Ambala, India, and the protocol was registered in the clinical trial registry of India (CTRI/2014/09/4986). The informed consent was signed by the participant who fulfills the inclusion criteria and they were recruited from the Tertiary Care Teaching Hospitals, Mullana. The inclusion criteria are diagnosed case of POAG, intraocular pressure more than 19 mmHg and less than 30 mmHg, and age was between 15 and 30 years for both genders. The subjects who have angle closure glaucoma, narrow angle glaucoma, secondary glaucoma, change of medication during treatment protocol, systemic diseases, apoplexy, skull-brain injuries, treatment with anticoagulants, any neurological disorder, strabismus, nystagmus, vestibular dysfunction, and hypersensitive and who underwent any surgical interventions in eyes and skull were exclusion criteria in the study. The subjects were recruited by an Ophthalmologist after full eye examination. Subjects were assessed subjectively for headache, eye strain, and eye pain. A total of 12 subjects with Primary open angle glaucoma were recruited through convenience sampling for the pilot study.[12] Study protocol flowchart is displayed in Fig. 1.

Interventions

Before the intervention on all the subjects the eye effleurage technique is performed for 3 min. Effleurage over the eyelid and globe is often beneficial with edema of the eyelid and scleral edema. During effleurage, as displayed in Fig. 2A, with the closed patient eyes, the therapist applies a gentle pressure over the eye globe and the move his/her finger in circular direction. Ruddy Technique is a series of muscle energy techniques designed to balance extra-ocular muscle tone. During Ruddy technique application as in Fig. 2B, with the closed patient eyes, the therapist places a finger across the eyelid from lateral to medial. With a finger of the other hand, a light percussion is performed over finger that lies on the closed eyelid. Orbital bony MFR was applied, in Fig. 2C, with the closed patient eyes. The therapist applies a gentle pressure on orbital bone and then gently lifts up and during this the pressure would not be released. In listening technique, from Fig. 2D, the traditional muscle energy principles was utilized with the physiotherapist applying resistance against the ocular globe as the patient attempts to look in a specific direction. MET and MFR were given to

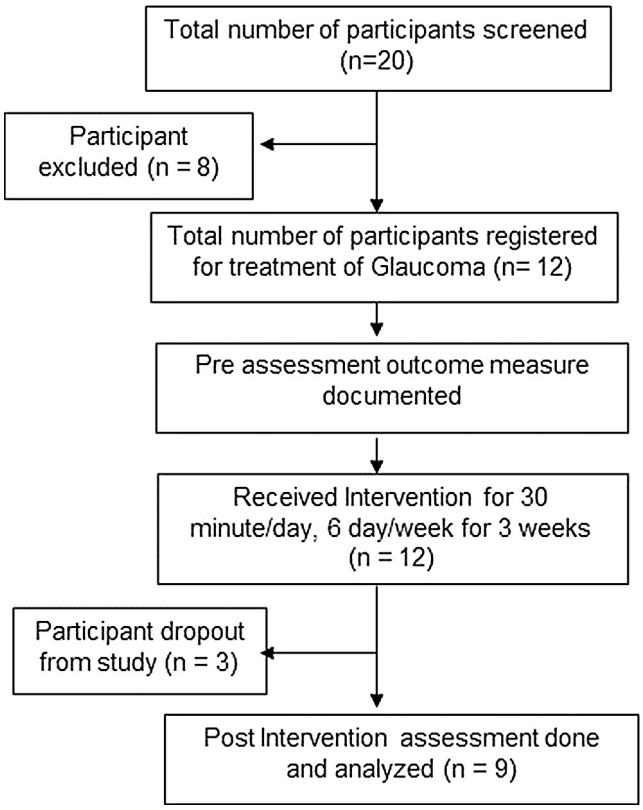

Fig. 1. Study flowchart.

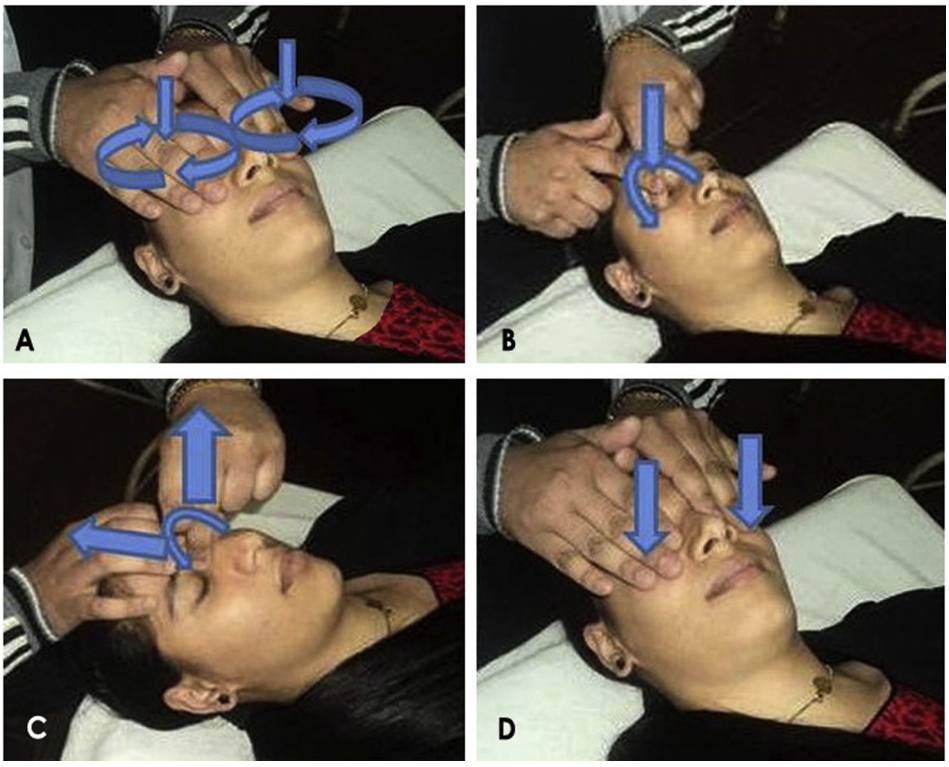

Fig. 2. (A) Application of effleurage technique to the patient; (B) application of Ruddy technique to the patient; (C) application of Orbital bony MFR; (D) Application of Listening Technique to the patient.

the patient for 30 min/day, six days/week for three weeks. Applanation Tonometer was used to measure the IOP changes by an Ophthalmologist who was blinded by almost the same time (±30 min variation) during the day just after the intervention in the patient with POAG. They reported subjectively that they had relieved from other symptoms such as eye strain, headache, eye ache and eye irritation. During the study period, no changes were made to the patient medications and the entire patient recruited received the same medication as shown in Table 1.

Data analysis

Statistical analysis for the present study was using the statistical software, statistical package for social sciences, SPSS version 16 (SPSS, version 16.0 Inc., Chicago, IL). Normality of the data was verified by Shapiro-Wilk test. Due to normally distributed data, central tendency was expressed as mean and standard deviation (SD). As there is no significant difference in recorded IOP between left and right eye, mean of both eyes was used for pre and post intervention IOP analysis. Significance of pre and post intervention IOP changes was determined by paired *T*-test. Probability values <0.05 were considered statistically significant < 0.01 were considered highly significant.

Table 1. Name of the medication used, with their dosage by the patients with POAG.

S. No	Eye Drops/Tablet	Frequency	Intensity
1.	EYEDOR 2% (Dorzolamide)	Three times/day	1 Drop in each eye
2.	FBN (Flurbiprofen)	Two times/day	1 Drop in each eye
3.	Cap Lycosara (Lycopene)	Once/day	1 Capsule
4.	Tab Dorzox (Dorzolamide)	Once/day	1 Tablet

Results

A total of 12 subjects of both genders were included in the study out of which, nine patients with POAG, 55% male and 45% female completed the study with a mean age of 24 ± 4.9 years. There is no significant difference ($p = 0.48$) among right (23.56 ± 3 mm of Hg) and left eye (22.4 ± 2.79 mm of Hg) in their IOP. Hence, the mean of right and left eye IOP was taken together as pre intervention IOP. The similar situation was observed in post intervention with right (20.4 ± 2.1 mm of Hg) and left eye (19.6 ± 1.5 mm of Hg) IOP having no significant difference ($p = 0.26$) between then. The mean of pre and post intervention IOP changes of the individual patient with POAG recruited is shown in Fig. 3. The overall pre and post intervention IOP changes are displayed in Fig. 4 with mean pre-post difference was 3.1 ± 1.9 mmHg with a significance difference of $p = 0.002$ (paired *T*-test) which is highly significant.

Discussion

This study demonstrates the effectiveness of MET and MFR on primary open angle glaucoma. The present study showed MET and MFR reduce intraocular pressure and relieve from other symptoms such as eye strain, headache, eye ache and eye irritation, reported subjectively by the

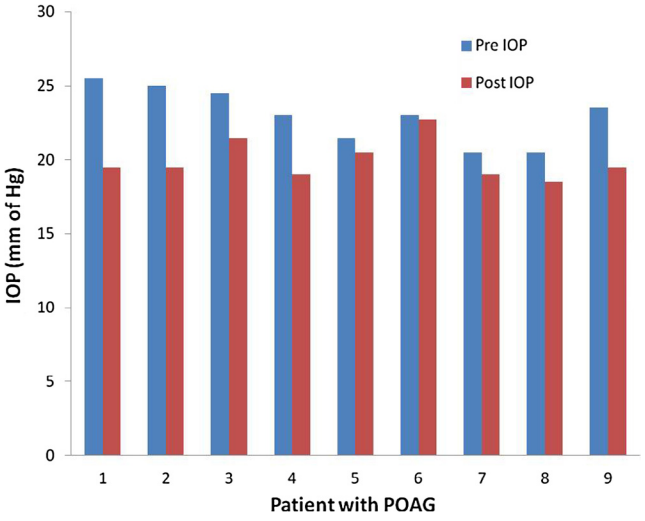

Fig. 3. Pre and post intraocular pressure (IOP) changes in the patients with primary open glaucoma (POAG).

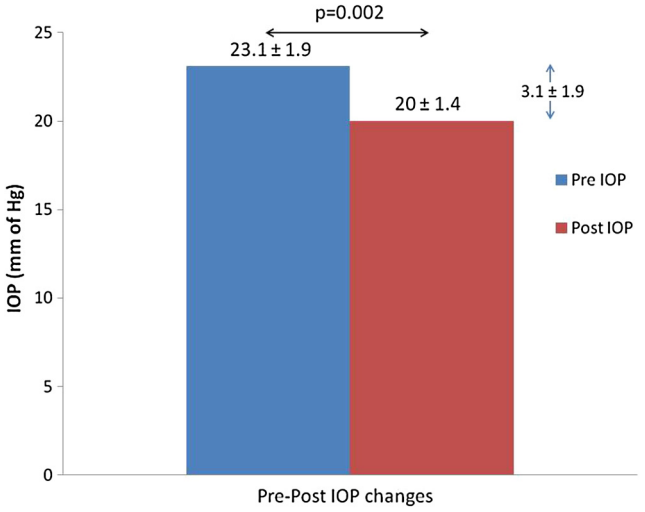

Fig. 4. Mean of Pre and Post intervention IOP changes.

patient. In the studies done by, Roddy and Ellemberg[13] concluded that exercise can reduce the IOP ranging by 1–5 mm of Hg and they obtained the different patterns of result. The active and sedentary participant has got equal benefit from exercise. Almost IOP reduced twice in the mild to moderate intensity and finely the duration of exercise can influence the outcome in case of mild to moderate intensity.

Natsis et al.[14] proved the reduction in IOP in healthy people (athletes an non-athletes) by aerobic exercise (walking, jogging, bicycling, etc.) with moderate intensity along with beta blockers, alpha agonist and prostaglandin.

IOP varies throughout the night and day. The diurnal variation for normal eyes is between 3 and 6 mmHg and the variation may increase in glaucomatous eyes. During the night, IOP may not decrease despite the slower production of aqueous humor. In the general population, IOP ranges between 10 and 21 mmHg with a mean of about 15 or 16 mmHg (±3.5 mmHg during a 24 h).[15] Hence all the IOPs for the patients with POAG were measured in the same time of the day to avoid the influence of the diurnal variation.

Lack of randomization and lack of control group were the main limitations of this study. Small sample size, not measuring physical activity level and not objectively documenting other symptoms were the other limitations. Effects of exercise on other type of glaucoma would be our future recommendations.

Conclusion

The significant effect of MET and MFR on POAG is concluded by the present study. This study will help the physiotherapist to upgrade their knowledge and contributes toward evidence based practice, thereby helping in determining the best and effective treatment for IOP in the field of ophthalmology.

Conflict of interest

The authors declared that there is no conflict of interest.

Acknowledgments

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