

ORIGINAL ARTICLE

Diagnosis and Treatment of Accommodative Spasm with Cycloplegics

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ABSTRACT

Purpose: To evaluate the role of cycloplegic agents in diagnosis and management of accommodative spasms.

Methods: Prospective cohort study included patients with recent onset ocular strain. All patients underwent comprehensive eye examination and objective refraction. Then patients were randomized to receive either atropine or cyclopentolate for cycloplegia. And objective refraction was recorded again. Patients were randomly assigned to one of the two treatments i.e. full cycloplegic correction or 0.001% atropine and reviewed at 1-, 2- and 3-month follow-ups.

Results: Total 52 patients, mean age 16.1 ± 4.7 were evaluated. 33 patients (63.5%) received atropine and 19 (36.5%) received cyclopentolate. There was significant difference between precycloplegic and post cycloplegic refraction however, the difference between cyclopentolate and atropine was not significant.

None of the patients, whether treated with glasses or low dose atropine experienced any ocular strain till the end of study.

Conclusion: Both cyclopentolate and atropine are equally effective in achieving adequate cycloplegia in patients with accommodative spasm. Plus corrective wear or low dose atropine are equally effective in relieving the symptoms of patients.

Keywords: Cycloplegic agents, Post-cycloplegic refraction, Accommodative spasm

INTRODUCTION

Accommodation is the ability of the eye to change its focus from distant to near objects. During near work, ciliary muscles are contracted to see things clearly. This process increases the plus refractive power of the crystalline lens. While viewing the distant objects, accommodation relaxes. However, accommodation fails to relax when viewing distant objects in rare cases. This spasm of accommodation that occurs due to prolonged ciliary muscle contraction is called accommodative spasm.¹ Clinically, it is also called pseudo-myopia, hyper-accommodation, or ciliary spasm.²⁻⁴ It has a reasonably good prognosis.^{5,6}

The etiology of accommodative spasm has not been precisely determined, but it is usually functional due to psychogenic factors triggered by anxiety, depression, and emotional distress. Accommodative spasm increases with the severity of psychological stress.⁷ Several children, especially girls, are affected in their pre-pubertal or pubertal period.⁸ There is also infrequent association with neurological disorders like myasthenia gravis, multiple sclerosis, and metabolic disorders, encephalopathy and head trauma.⁸

Accommodative spasm can be relieved by strong cycloplegics like atropine.⁹ Atropine is used both for the diagnosis and management. Even milder cycloplegics can be used in combination with eye exercises and spherical correction.¹⁰

Ciliary muscles' spasms lead to decreased visual acuity.¹¹ However, pupillary light reactions, extra-ocular

motility, anterior and posterior segment examinations remain unremarkable.¹¹ In rare cases, if this condition is untreated initially, it has to be managed surgically like clear lens extraction.¹²

As the presentation of the patients varies regarding signs and symptoms, the protocol for the management also differs. The type of cycloplegics, administration duration, and additional therapy is variable.

This study aimed at evaluating the role of cycloplegic drugs in the detection and management of accommodative spasm.

METHODOLOGY

It was a single-center prospective cohort study, conducted at Aziz Fatimah Medical and Dental College (AFM&DC), Faisalabad, aimed at evaluating the role of cycloplegic drugs in the diagnosis and management of spasm of the accommodation. The study's protocols adhered to the tenets of the declaration of Helsinki and were approved by the ethics committee at AFM&DC. It included patients of either gender, aged 6-25 years, who visited our Ophthalmology department with a recent onset ocular strain with or without blurred vision. Exclusion criteria were any active ocular disease/ infection, history of ocular surgery, history of contact lens wear within the past three months, systemic diseases, and drugs known for changes in refractive status.

Fifty-two individuals, both male and female, were recruited using non-probability convenient sampling. All

patients underwent a detailed history and comprehensive ocular examination. Cycloplegia was induced using atropine or cyclopentolate, and patients were randomly assigned to receive one of the two drugs. A single clinician, blinded to the type of drug, performed objective refraction before and after cycloplegia. Objective refraction was determined using retinoscopy and auto-refraction by the same clinician and an average from both readings was used for analysis. Patients were treated with either full cycloplegic correction or 0.001% atropine, randomly and followed at one month, 2, and 3 months for recurrence of symptoms.

Data were analyzed using SPSS 28 (IBM Inc). All quantitative normally distributed data were presented as Mean \pm SD, and non-normally distributed data were presented as median [IQR] while qualitative data were expressed as counts(percentage). Paired sample t-test was used to compare the change in refraction induced by cycloplegia. Repeated measure ANOVA was used to compare the effect of two drugs on shift in refraction.

RESULTS

A total of 52 patients, including 31 females (59.6%) were evaluated. Mean \pm SD age was 16.1 \pm 4.7 years. Male individuals were younger than females 13.67 \pm 5.36 years vs. 17.74 \pm 3.32 years ($t=3.39$, $df=50$, $p<0.001$). Thirty-eight (73.1%) patients were from an urban area, and the rest of 14 (26.9%) were from rural. Overall, the mean visual acuity in the right eye was 0.74 \pm 0.28 and 0.86 \pm 0.23 in the left eye. Visual acuity in right was less than left eye (Mean difference = 0.12, $t=3.37$, $df=51$, $P<0.001$). Mean precycloplegic VA was 0.74 \pm 0.28 and post cycloplegic VA was 0.79 \pm 0.25 in the right eye and 0.86 \pm 0.23 pre cycloplegic and 0.87 \pm 0.19 in the left eye. There was no difference between pre-and post-cycloplegic VA in either eye ($P>0.2$ all). **Figure 1**

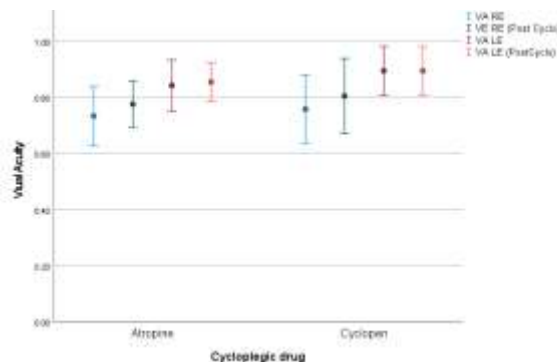


Figure 1: Mean [error bar 95% CI] Visual acuity before and after cycloplegia

Abbreviations; VA= visual acuity, RE= Right Eye, LE= Left Eye, Cyclo= Cycloplegia

Atropine was used for cycloplegia in 33(63.5%) patients and cyclopentolate in 19 (36.5%) patients. Repeated measure ANOVA was used to test the between and within the subject effects of cycloplegia, cycloplegic drugs and gender on refraction.

There was a significant change in refraction induced by cycloplegia in right (Mean R precycloplegic SE -

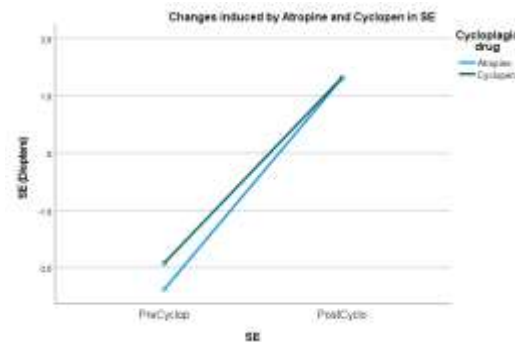
2.21 \pm 1.11 vs post cycloplegic SE 1.31 \pm 0.47 $P<0.001$) and left eye (precyclo -1.68 \pm 1.1 vs post cyclo 1.48 \pm 0.54 DS).

Table 1

Table 1: Mean \pm SD refraction before and after cycloplegia in right eye (RE) and Left Eye (LE) with Atropine (At) and Cyclopentolate (Cy).

Parameter	PreCycloplegic	Post Cycloplegic	Mean Difference	Sig
SE RE	-2.21 \pm 1.11	1.31 \pm 0.47	3.5 \pm 1.34	T -18.90, df51, $p<0.001$
SE LE	-1.68 \pm 1.1	1.48 \pm 0.54	3.16 \pm 1.1	T -21.2, df 51, $p<0.001$
SE R (At)	-2.38 \pm 0.92	1.30 \pm 0.47	3.68 \pm 1.13	T -18.73, 32, $p<0.001$
SE R (Cy)	-1.92 \pm 1.36	1.31 \pm 0.48	3.24 \pm 1.65	T -8.57, 18, $p<0.001$
SE L (At)	-1.82 \pm 0.68	1.58 \pm 0.56	3.39 \pm 0.80	T -24.28, 32, $p<0.001$
SE L (Cy)	-1.43 \pm 1.57	1.32 \pm 0.48	2.75 \pm 1.36	T -8.82, 18, $p<0.001$

There was a significant difference between pre cycloplegic and post cycloplegic refraction 3.5 \pm 1.34 D ($T=-18.90$, $P<0.001$) in right eye and 3.16 \pm 1.1 D ($t=-21.2$, $P<0.001$) in left eye. There was no difference between atropine and cyclopentolate in terms of change in refraction ($F=2.53$, $df=1$, $P=0.12$) (**Figure 2**)



Twenty-two (19.2%) patients were treated with refractive correction and 31(59.6%) received low dose atropine (0.001%) for management of the asthenopic symptoms. All patients completed the scheduled follow up. None of the patients had recurrence of symptoms till the end of study.

DISCUSSION

Accommodative spasm usually presents with frontal headache and blurred vision. It may be an entity of spasm of near reflex (SNR) or occurs independently as pseudo-myopia. SNR comprises of accommodative spasm, miosis and variable degree of esotropia. Spectacle correction alone is an ineffective and quantitative response on examination is variable. Spasm mainly affects children and young adolescents.⁶ Females in the prepubertal and pubertal age groups are affected.¹³ In our study, 60% of females were affected, which is compatible with the above data.

Sandra W documented that prolonged near work affects the ciliary muscle morphology and accommodation.¹⁴ The ciliary muscle imaging can be done

using optical coherence tomography (OCT). The accommodation was assessed to a stepwise increment from 0.25D to 4D using eccentric photorefractive before and after a 30-min reading at 25cm. The mean accommodation response increased after near work.

Accommodative spasm is a known etiological association of acute acquired onset transient esotropia which is a diagnostic dilemma and requires a comprehensive examination and cycloplegic refraction for diagnosis and appropriate management.¹⁵

Anxiety, stress and prolonged screen hours are also known to increase the risk of accommodative spasm and related manifestations.⁷

Cycloplegic refraction is the mainstay of the diagnosis and management of spasm of accommodation. Usual manifest refraction is changed to hyperopic refraction after adequate cycloplegia. Atropine 1% and Cyclopentolate 1% are commonly used for inducing adequate cycloplegia. Our results suggest that despite being a more potent cycloplegic drug, atropine had a similar/ equivalent effect on the refraction when corrected for gender and age. Based on these findings, both drugs are equally effective in achieving adequate cycloplegia.

Plus correction lenses, cycloplegic drugs and vision therapy have been known for managing spasm of accommodation and pseudo-myopia.^{2,3,5} In our study, patients were randomized to either receive low dose atropine or full cycloplegic correction. The outcomes were presence/ recurrence of symptoms at 1, 2 and 3-month follow-ups. All patients completed final outcome visits and did not report any symptoms at each visit.

In conclusion, cycloplegic refraction is the mainstay of diagnosis and management of spasm of accommodation and pseudo-myopia. A marked shift in refraction from myopic to hypermetropic reading after cycloplegia is a strong indicator of pseudo-myopia induced by spasm of accommodation. Both cyclopentolate and atropine are equally effective in achieving adequate cycloplegia and thus diagnosis. Low dose atropine and refractive correction (cycloplegic) are effective in relieving patients' symptoms.

REFERENCES

1. Lindberg L. [Spasm of accommodation]. *Duodecim; laaketieteellinen aikakauskirja*. 2014;130(2):168-173.
2. Griffin JR, Grisham JD. *Binocular anomalies: diagnosis and vision therapy*. Butterworth-Heinemann Medical; 2002.
3. Rutstein RP, Daum KM, Amos JF. Accommodative spasm: a study of 17 cases. *Journal of the American Optometric Association*. 1988;59(7):527-538.
4. Wajuhian SO, Hansraj R. A review of non-strabismic accommodative and vergence anomalies in school-age children. Part 2: Accommodative anomalies. *African Vision and Eye Health*. 2015;74(1):7.
5. Jeffrey S, Cooper, Carole R, Burns, Susan A, Cotter, Daum KM, Griffin JR, Mitchell M, Scheiman. *Care of the Patient with Accommodative and Vergence Dysfunction. OPTOMETRIC CLINICAL PRACTICE GUIDELINE*. St Louis: American Optometric Association; 2001.
6. Goldstein JH, Schneekloth BB. Spasm of the near reflex: a spectrum of anomalies. *Survey of ophthalmology*. 1996;40(4):269-278.
7. Kara H, Yasar E, Gurlevik U. Is pseudomyopia associated with anxiety and related disorders? *Pakistan Journal of Medical Sciences*. 2021;37(5):1514.
8. Hughes FE, Treacy MP, Duignan ES, Mullaney PB. Persistent pseudomyopia following a whiplash injury in a previously emmetropic woman. *American journal of ophthalmology case reports*. 2017;8:28-30.
9. Satgunam P. Relieving accommodative spasm: two case reports. *Optom Vis Perform*. 2018;6:207-212.
10. Hussaindeen JR, Mani R, Agarkar S, Ramani KK, Surendran TS. Acute adult onset comitant esotropia associated with accommodative spasm. *Optometry and vision science : official publication of the American Academy of Optometry*. 2014;91(4 Suppl 1):S46-51.
11. Peinado GA, Merino Sanz P, Del Cerro Pérez I, Gómez de Liaño Sánchez P. Unilateral accommodation spasm: Case report and literature review. *Archivos de la Sociedad Española de Oftalmología*. 2019;94(6):285-287.
12. Gedar Totuk OM, Aykan U. A new treatment option for the resistant spasm of accommodation: clear lens extraction and multifocal intraocular lens implantation. *Int J Ophthalmol*. 2018;11(1):172-174.
13. Hyndman J. Spasm of the Near Reflex: Literature Review and Proposed Management Strategy. *Journal of binocular vision and ocular motility*. 2018;68(3):78-86.
14. Wagner S, Schaeffel F, Zrenner E, Straßer T. Prolonged nearwork affects the ciliary muscle morphology. *Experimental Eye Research*. 2019;186:107741.
15. Allegri D, Montesano G, Fogagnolo P, et al. Transient Esotropia in the Child: Case Report and Review of the Literature. *Case Rep Ophthalmol*. 2017;8(1):259-264.