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Original Article

Ophthalmology Section

Effect of Acupuncture on Waveform Characteristics and Visual Acuity in Idiopathic Infantile Nystagmus: A Prospective Interventional Study

DHIVYA ASHOK KUMAR[1], PRADEEP SHARMA[2], ROHIT SAXENA[3]

ABSTRACT

Introduction: Idiopathic Infantile Nystagmus or Infantile Nystagmus Syndrome (INS) is one of the known causes for congenital nystagmus. Though the exact aetiology is unknown, there have been studies related to its treatment using prisms and contact lens. However, there have been not many clinical studies using the alternative therapy like acupuncture is done to analyse the effect on nystagmus. Therefore, the rationale of the study was to know the effect of acupuncture in INS and identify the same by Videonystagmography (VNG).

Aim: To evaluate the effect of acupuncture on waveform characteristics and visual acuity in INS.

Materials and Methods: This prospective interventional study was performed at Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, India, during the period of March 2004 to March 2006. Institutional Review Board/Ethical Clearance was obtained and patients with INS of more than 18 years, who were co-operative, underwent acupuncture needle stimulation of sternocleidomastoid. The needles in sternocleidomastoid were stimulated every five minutes for 15 minutes for 10 sittings (5 days). Nystagmus parameters like slow phase velocity, amplitude, frequency were recorded by VNG for 20 minutes. Changes in waveform and visual acuity (Snellen visual acuity charts) were examined on every visit on all five days and patients were followed-up for three months. Visual acuity, nystagmus intensity, amplitude, frequency and slow phase velocity were the parameters analysed. A repeated measure- Analysis of Variance (ANOVA) test and Freidman test was performed using Statistical Package for the Social Sciences (SPSS) (version 16.1) to analyse the data. A p-value <0.05 was considered significant.

Results: Ten patients with INS underwent the procedure. Significant improvement in distant visual acuity was noted at three months (right eye p=0.039, left eye p=0.050). Significant decrease in frequency during treatment (p=0.046, p=0.014 at 10 minutes and 15 minutes, respectively) was noted. Dampening of nystagmus amplitude was seen during acupuncture therapy, which got enhanced by twirling of the needles. No permanent changes in waveform characteristics were seen after therapy in the follow-up for over three months.

Conclusion: The afferent stimulation from neck muscles by acupuncture in infantile nystagmus does affect waveforms during therapy and visual acuity after the therapy on short-term.

Keywords: Acupuncture therapy, Foveation duration, Infantile nystagmus syndrome, Nystagmography, Videonystagmography, Waveform changes

INTRODUCTION

The INS usually presents in the first six months. Characteristics for INS are accelerating slow phase velocity, presence of null, decrease on convergence and increase on fixation. No neurological involvement is seen [1]. The origin of INS remains unknown. It is hypothesised to be due to high gain instability in slow eye movements and the neural integrator. The patients with INS have better near vision and good binocular vision and monocular vision. But visual acuity is still more affected than in manifest-latent nystagmus [1]. Foveation duration is identified as the single main factor in determining the visual acuity [2]. Previous studies have shown that the waveform and foveation vary widely [3]. Waveforms evolve from simple to more complex, as the infant gets older.

Numerous treatments have been described for congenital nystagmus. These include contact lenses [4], prisms [5,6], biofeedback [7-9], acupuncture [10,11] and surgical procedures [6,12]. Vibratory and electrical stimulation of face and neck was found to improve foveation and acuity in some patients [2]. Though there have been studies related to prisms and contact lens treatment in INS; there are not many reported on the effect of acupuncture in nystagmus [10]. Even though various modalities have been tried, no single treatment has shown overwhelming response clinically. Therefore, the aim of the present study was to evaluate the effect of acupuncture on waveform characteristics and visual acuity in INS. Here, the needles were inserted in sternocleidomastoid muscle in patients with INS and waveform changes were analysed.

MATERIALS AND METHODS

This prospective interventional study was performed in the tertiary care centre {Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences (AIIMS), New Delhi , India}, during the period of March 2004 to March 2006. The ethical clearance was obtained from Ethics Committee, AIIMS, 2004. After the procedures were explained in detail to the patient, a written informed consent was taken from them. The sample size was obtained from a previous similar study [10].

Inclusion criteria: Patients with INS with age more than 18 years, with informed consent for the procedure were included.

Exclusion criteria: Patients whose age was less than 18 years, with pre-existing corneal, optic nerve or retinal pathologies, unco-operative patients and patients not willing for follow-up were excluded from the study.

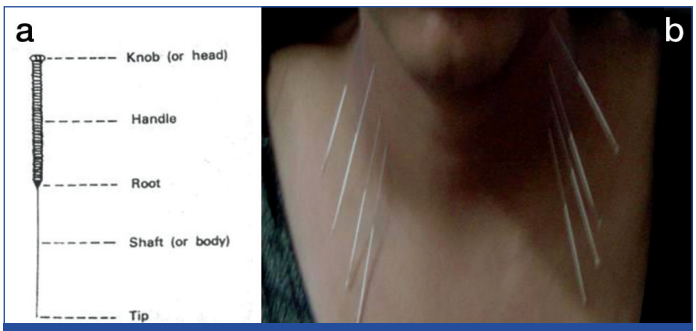
Study Procedure

The pretreatment parameters taken were visual acuity in primary and null position, both uncorrected and best corrected on the

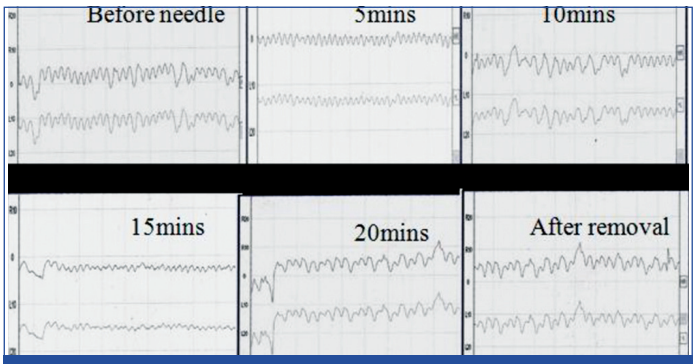
Snellen distant acuity chart and converted into decimal equivalent for statistical analysis. Near vision was recorded in Times New Roman types and converted into distant equivalent for statistical analysis. Contrast sensitivity was tested by the Pelli-Robson charts and stereopsis with TNO (The Netherlands Organisation for Applied Scientific Research) testing charts [13]. Preoperative nystagmus parameters like intensity, amplitude, frequency and slow phase velocity were recorded in VNG-CHARTR.

Before starting the VNG recording, video adjustment and calibration were done. For calibration the machine gives a sinusoidal target and the patient was asked to follow it. Adjustment was done to calibrate to standard waveform for both horizontal and vertical movements for each eye.

Acupuncture needles of stainless steel, about 0.2 mm diameter and 4 cm in length were used. A total of four needles on each side were inserted, in the middle one third of anterior surface of sternocleidomastoid muscle [Table/Fig-1] [14]. The VNG recordings were taken at baseline (0 minutes/before needle insertion), then continued were removed (at 20 minutes) till the needles were removed (at 15 minutes). Every five minutes needles were manually twirled and VNG recordings were made. The length of each VNG recording was about 40 seconds. The needles were removed at 20 minutes and VNG was without needles [Table/Fig-2]. Each patient underwent similar sittings twice daily for five days. A total of 10 sittings per patient were done. In order to see whether the acupoints in sternocleidomastoid were specific, sham therapy was done by stimulating deltoid muscle. It was found that there were no similar changes induced on VNG by sham therapy. All patients were followed-up after one and three months. All parameters were examined during the treatment and at each follow-up. The VNG recordings were performed in all gazes (central, levoversion and dextroversion) and also with left eye occlusion and right eye occlusion. Patients were asked if they were willing for repeat therapy or any discomfort during the treatment.



[Table/Fig-1]: Image of acupuncture needle (a) and the positioning of needles in the sternocleidomastoid of the neck during the study (b).



[Table/Fig-2]: Videonystagmography (VNG) tracings after 5,10,15, 20 minutes after introduction of acupuncture needles and after removal of acupuncture needles.

STATISTICAL ANALYSIS

For data analysis, data was entered in Microsoft excel and analysed by SPSS Version 16.1 (SPSS, Inc, Chicago, Illinois, USA). Statistical computations and graphical presentations were made. Repeated measures ANOVA test and Friedman test were used for analysis. A statistical p-value <0.05 was considered significant.

RESULTS

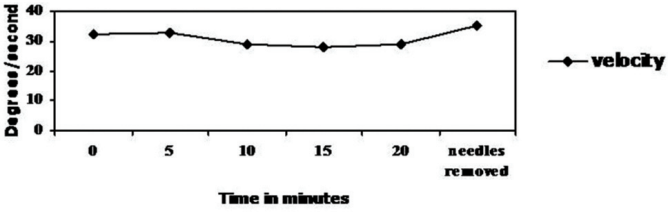
Out of the 10 patients there were two females and eight males. Nine of them had jerk nystagmus while one patient had pendular nystagmus. Family history of nystagmus was seen in first degree relatives in two patients.

Visual acuity: Monocularly all patients showed improvement for distant vision in primary gaze {right eye (Freidman test p=0.039) and left eye (p=0.050)} [Table/Fig-3]. There was no statistical significant change seen in near vision [Table/Fig-3] even though there was clinical improvement. Binocular visual acuity [Table/Fig-3] showed trend for improvement for distant (p=0.050). No change in near vision (p=0.135) in primary gaze was noted. No significant change in binocular visual acuity noted in null gaze.

Eye	Distant Mean±SD	Near Mean±SD
Right eye BT	0.36±0.2	0.28±0.2
Right eye F1	0.42±0.3	0.35±0.2
Right eye F2	0.43±0.3	0.35±0.2
p-value	0.039	0.135
Left eye BT	0.35±0.3	0.22±0.2
Left eye F1	0.37±0.3	0.28±0.2
Left eye F2	0.37±0.3	0.28±0.2
p-value	0.050	0.135
Both eyes BT	0.4±0.3	0.31±0.2
Both eyes F1	0.43±0.3	0.38±0.2
Both eyes F2	0.43±0.3	0.38±0.2
p-value	0.050	0.135

[Table/Fig-3]: Best corrected visual acuity in primary position.
*Test: Freidman test
BT: Before treatment; F1: Follow-up after one month; F2: Follow-up after three months

Slow phase velocity: Variable response was obtained in velocity in various positions namely in center, dextroversion, levoversion, right occlusion, and left occlusion (p=0.019) over a period of three months. The change in slow phase velocity during therapy is shown in [Table/Fig-4,5].



[Table/Fig-4]: Graphic depiction of chronological change of mean slow phase velocity during therapy.

Amplitude: No statistical significant changes were seen in amplitude from pretreatment, post-treatment, first follow-up and second follow-up. The change in amplitude during therapy is shown in [Table/Fig-6].

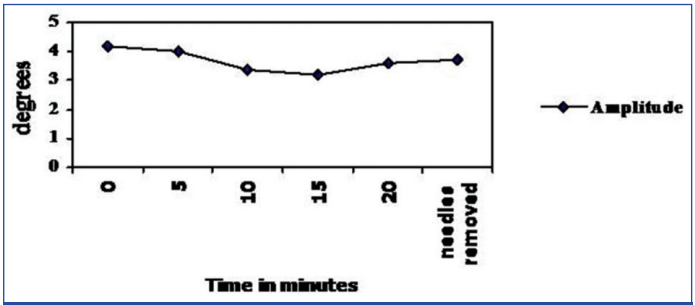
Frequency: There was significant reduction in frequency during the therapy at baseline 0 to 10 (p=0.046) and 15 minutes (p=0.014) [Table/Fig-7]. However, there was no difference was from pre to post-treatment and follow-up [Table/Fig-8].

Intensity: No statistical significant changes were seen in intensity from pretreatment, post-treatment, first follow-up and second follow-up.

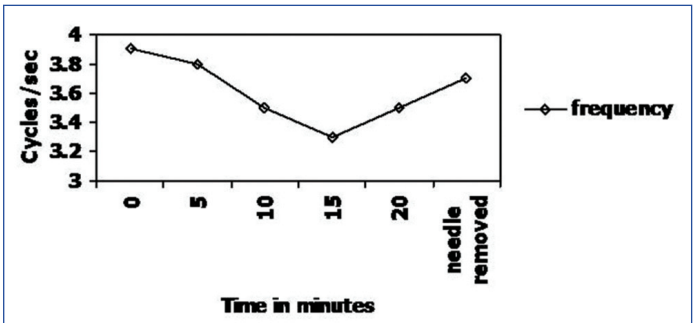
During therapy: Clinical variations were noted during needles in position in the neck. There was significant reduction in frequency during the therapy at baseline 0 to 10 (p=0.046) and 15 minutes (p=0.014). No statistical significant reduction was noted in amplitude and velocity during the therapy (Repeated measures ANOVA test) [Table/Fig-8].

Variables	BT		AT		F1		F2		p-value
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	
Center	36.4±28	22.9	35±28	20.4	36±27	22.9	38±31.4	24.3	0.540
Dextroversion	46±36	43.5	46±36	43.5	48±35	46.8	48±36	46	0.941
Levoversion	40.5±29	46.3	42±29	45.3	42±30.5	46.7	40±29	44.3	0.218
Right occlusion	35.5±32	24.8	38±34.2	28	42±36	24.3	33±30	19.2	0.392
Left occlusion	32.6±32	21.2	23±25	12	28±25	16.9	25±20	20.7	0.019

[Table/Fig-5]: Mean slow phase velocity (degrees/second).
BT: Before treatment; AT: After treatment; F1: Follow-up after one month; F2: Follow-up after three months; M: Mean; SD: Standard deviation. Test: Repeated measures ANOVA



[Table/Fig-6]: Graphic depiction of chronological change of mean amplitude of nystagmus during therapy.



[Table/Fig-7]: Graphic depiction of chronological change of mean frequency of nystagmus during therapy.

Variables	0 min	5 min	10 min	15 min	20 min	Needles removed	p-value
Frequency (cycles/sec)	3.9±1.2	3.8±1.4	3.5±1.4	3.3±1.6	3.5±1.4	3.7±1.2	0.446
Amplitude (degrees)	4.2±2.6	4±3	3.4±2	3.2±1.2	3.6±2.3	3.7±3	0.183
Velocity (degrees/second)	32±23	32±25	29±19	28±18	29±22	35±28	0.940

[Table/Fig-8]: Nystagmus characteristics during therapy.
*Test: Repeated measures ANOVA

Contrast sensitivity: There was no significant change noted in contrast sensitivity postoperatively (p=0.097).

Stereopsis: Except for gross stereopsis in one patient, no patient had stereopsis before treatment. No change in stereopsis was noted in any patient after treatment.

There was subjective improvement in all patients. There were patients who wanted to undergo repeated sittings in future. No complications were seen in any patients during or after treatment. All the patients were older than 18 years and there was no difficulty in co-operation during treatment. Some patients showed anxiety during initial sittings but that was overcome during successive sessions. Compliance of the patients during the follow-up period was good.

DISCUSSION

The INS is usually seen as early onset, typically at infancy and the cause is often unknown. There have been various modalities tried for nystagmus treatment [5,15]. Methods that place the eye in a position in which nystagmus is minimised like convergence prisms for patients, if nystagmus is less in viewing near target has been an option. Optical and electronic methods for negating the visual consequences of the nystagmus by using high positive spectacle lens worn in combination with high negative contact lens can be utilised to stabilise the image on retina. Surgical intervention procedures like- Kestenbaum procedure or modified Anderson surgery has been known to correct head tilt or abnormal head position in nystagmus. Application of somatosensory or auditory stimuli to suppress nystagmus and drugs that suppress some forms of nystagmus has also been tried [5]. Blechschmidt T et al., showed improvement in visual acuity and contrast sensitivity by applying acupuncture therapy in various parts of body like ears, head, neck, abdomen and limbs [16]. Blekher T et al., used scleral search coils for documenting changes in nystagmus after acupuncture treatment on sternocleidomastoid [10]. They showed that four out of the six patients improved foveation after the commencement of treatment; three maintained the response throughout the treatment period and after the needles were removed.

In the present study, visual acuity showed a trend for improvement for distance. All the patients who showed improvement in vision in first follow-up maintained the same for next three months. No patient showed deterioration of vision during the entire study and follow-up. This was in line with the studies done by Blekher T et al., and Ishikawa S et al., [10,11]. Afferent stimulation either in the form of contact lens stimulating the trigeminal nerve or vibratory or electrical stimuli from forehead or neck has known to damp congenital nystagmus [6]. In the present study results also, amplitude, frequency and intensity did show clinical improvement from pretreatment to post-treatment. However, change was noted in frequency alone during therapy. Individual patients responded to the stimuli during therapy in a variable manner in all three parameters namely amplitude, frequency and velocity. In the study by Blekher T et al., all six patients demonstrated statistically significant reduction of mean slow phase velocity during acupuncture [10]. Their study reported, that the frequency lowered after treatment [10]. The waveform characteristics were not significantly affected by acupuncture in the present study with respect to various gazes in pretreatment, post-treatment, and in follow-up periods. However, good response was seen in waveforms during the needles in position.

Speculation as to how acupuncture affects nystagmus waveforms and visual acuity cannot be explained because of lack of exact mechanism of action of acupuncture in congenital diseases. The possible mechanism through which acupuncture acts could be by increasing the foveation time in each cycle. Of the various mechanisms, one is the principle of cybernetics in which the actual amount of stimulation may be quite small, but it creates an afferent impulse which travels from the muscle to central nervous system and intervenes in the biological feedback mechanism and serves to normalise its operation [14]. The biological feedback loop would be the slow eye movement control system which is a closed loop.

According to study by Blekher T et al., there was significant change in foveation window during treatment [10]. Another study by Ishikawa S et al., showed decrease in amplitude after acupuncture [11]. Sheth NV et al., noted changes in foveation after stimulation of neck muscles by vibration and electrical stimuli [2]. These studies did not evaluate the visual acuity after stimulation of neck muscle. Present

study results express that afferent stimulation by acupuncture can change visual acuity in infantile nystagmus, though the changes in waveform characteristics were more during the therapy.

Limitation(s)

The limitations of the study were the absence of control group, small population and short duration follow-up.

CONCLUSION(S)

There was clinical improvement in visual acuity for distance. There was improvement in waveform characteristics during the acupuncture therapy. However, the effects of acupuncture during the therapy on the waveform characteristics were transitory. Long term effects on continued treatment with repeated sessions of acupuncture are recommended for future analysis. Further studies can be conducted with a larger sample size, longer duration of treatment, long follow-up period and a control group to shed more light over the therapeutic benefits of acupuncture in infantile nystagmus.

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PARTICULARS OF CONTRIBUTORS:

1. Consultant, Department of Oculoplasty, Dr. Agarwal's Eye Hospital and Eye Research Centre, Chennai, Tamil Nadu, India.
2. Consultant, Department of Neurophthalmology, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, India.
3. Consultant, Department of Neurophthalmology, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Dhivya Ashok Kumar,
Consultant, Department of Oculoplasty, Dr. Agarwal's Eye Hospital and Eye Research Centre, Chennai, Tamil Nadu, India.
E-mail: susruta2002@gmail.com

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