

Case Report / 증례

A Case of Paralytic Strabismus Caused by Midbrain Infarction

Se-Hee Oh · Seung-Ug Hong

Department of Ophthalmology, Otolaryngology and Dermatology of Korean Medicine,
College of Korean Medicine, Dongguk University

중뇌경색으로 인한 마비성 사시의 한방 치험 1례

오세희¹ · 홍승욱²

동국대학교 일산한방병원 한방안이비인후피부과 (1수련의, 2교수)

Abstract

Objectives : Paralytic strabismus refers to the nerve paralysis in the muscles responsible for the movement of the eyeball for any reason, resulting in a restriction of eye movement. This study is to report a case of the paralytic Strabismus caused by midbrain infarction treated with Korean medicine.

Methods : Patient received Korean medical treatment such as acupuncture & herbal medicine (Saengkankunbi-tang).

Result & Conclusion : During 15 weeks of the treatment, patient's strabismus and diplopia were improved.

Key words : Paralytic Strabismus; Midbrain Infarction; Diplopia

I. Introduction

Paralytic strabismus refers to the nerve paralysis in the muscles responsible for the movement of the eyeball for any reason, resulting in a restriction of eye movement. There are three cranial nerves involved in the extraocular muscles. Trochlear nerve, the 4th cranial nerve works on superior oblique muscle. Abducens nerve, the 6th cranial nerve adjusts external rectus muscle. Oculomotor nerve, the 3rd cranial nerve controls the rest of extraocular muscle.

Paralytic strabismus are caused by vascular risk factors such as high blood pressure, or by compressive lesions such as aneurysm in the vertebral artery, tumors, intracranial pressure, or head trauma, multiple sclerosis, and meningitis¹⁾.

Identifying the underlying causes is essential to diagnose and treat the paralytic strabismus, but It's often impossible to determine. Initially, corticosteroids and vitamins are administered, and surgery can be considered if the symptoms do not improve after at least 6 months of observation^{2,3)}.

In Korean medicine, there are various diseases that refer to strabismus, and depending on the severity or types of the symptoms, the name of the disease is expressed differently. Symptoms include sudden unilateral or bilateral strabismus, with

vertigo, headache, nausea, and vomiting^{4,5)}. The principle of the treatment is divided in two types with the concept of the occurring pace of the disease. If the development is fast, the principle is to subside spasm through improving blood circulation and removing cachexia. If the development is slow, improving hematological status and relaxing body muscles would be the principle of the treatment. Diagnosing etiological factor, the treatment focus would be different. For instance, If there is a disease caused by deficiency of the kidney and liver energy, the main treatment should be focused on reinforcing those organ energy. If metabolic waste is the problem, the treatment should be eliminating waste from the body⁵⁾.

There are many case reports about paralytic strabismus such as the case of Benedikt's syndrome patient reported by Jeong et al⁶⁾, 3 cases which are treated with Homnis placenta pharmaco-acupuncture reported by Jung et al⁷⁾, or the case of a patient with midbrain and Thalamus hemorrhage reported by Lee et al⁸⁾. However, There are no studies about a case of monocular partial oculomotor nerve palsy in a patient with midbrain infarction.

This case report describes Korean medical treatment for monocular partial oculomotor nerve palsy caused by midbrain infarction.

II. Objects & Methods

1. Objects

In this study, we studied 1 patient who had

Corresponding author : Seung-Ug Hong, Department of Korean Medicine Ophthalmology & Otolaryngology & Dermatology, Dongguk University, 27, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do, Republic of Korea.(Tel : 031-961-9085, E-mail : heenthstu@duih.org)

•Received 2019/4/6 • Revised 2019/4/17 • Accepted 2019/4/24

adduction deficit and diplopia caused by oculomotor nerve palsy. The patient has been fully explained and agreed that patient information could be used to publish this paper.

This study was approved on April 12, 2019 by IRB of Ilsan oriental hospital, Dongguk university(DUIOH 2019-04-003).

2. Evaluation Methods

1) Adduction deficit

We measured the distance from nose to center of the Rt. pupil to determine the distance of Rt. ocular movement.

2) Diplopia

The diplopia was rated as severe+++ , moderate++ , mild+ , trace± , elimination- depending on the patient's subjective feelings.

III. Case Report

1. Patient : ○○○ (M/59)

2. Chief complaint

1) Limited Rt. eye movement : Adduction deficit
- No voluntary movement from the center to the inside of Rt. eye

2) Diplopia

- As the patient's gaze moved from the right to the left, the diplopia phenomenon became apparent, making it impossible for the patient to walk without an eye patch on his Rt. eye.

3. Onset : December 11, 2018

4. Past History

- 1) Hypertension
- 2) Dyslipidemia

5. Family History : None of specific

6. Social History

- 1) Drinking : 5 times/week, 2-3 btls
- 2) Smoking : 1.5-2 ppd × 30 yrs

7. Present Illness

A 59-year-old male patient with slightly obese body types (height 178.4cm, body weight 100kg) suddenly developed diplopia on December 11, 2018. He was hospitalized in the Neurology Department of General Hospital on December 12, 2018 and was diagnosed with midbrain infarction. He received conservative treatment such as taking Aspirin for 7 days. On December 19, 2018, He started Korean medical treatment.

8. An Initial Opinion

- 1) Whole body condition : Red-faced, Sweaty, Slightly obese body types
- 2) Digestive system : Normal
- 3) Respiratory system : Normal
- 4) Sleep : Slightly bad (6hrs/day, Shallow)
- 5) Defecation : 1 time/day
- 6) Voiding : Normal
- 7) Personality : Hot-tempered

9. Examination results

1) Brain MRI without CE+MRA

- ① r/o acute infarction in midbrain
- ② Mild cerebral atrophy with nonspecific white matter change
- ③ Mild vascular irregularity in the intracranial arteries
 - No significant stenosis or vascular malformation in this MRA
- ④ No significant stenosis in intracranial arteries and both proximal ICA

2) Clinical pathology

- ① Blood chemistry : CK 234(<190), Glucose 115(74-109), BUN 24.3(6-23), Creatinine 1.56 (0.70-1.20), AST 52 (≤40), ALT 82 (≤40), Others : WNL
- ② Routine CBC : Neutrophil 40.5(43-70), Lymphocyte 48.9(20-44), MCV 101.7(81-96), MCH 33.8(27-33), Others : WNL
- ③ U/A : WNL
- ④ HBsAg(-), Ab(+)

10. Treatment

1) Herbal medicine

The patient took *Saengkankunbi-tang*(生肝健脾湯) 2 times a day during December 19 to 21, 2018. and the same medicine was prescribed for 15 days at discharge. After that, the patient didn't want any more herbal medicine treatment, so the treatment was suspended.

2) Acupuncture treatment

The acupuncture needles were 0.25×40mm stainless steel standardized, and disposable.

(The Eastern acupuncture equipment manufacturer, Boryung, Korea) Acupuncture was administered at LI4, ST1, EX-HN4, GB1, TE23, BL2, GB20 for 15 minutes twice a day during hospitalization period. After discharge, acupuncture was administered at same points for 15 minutes twice or three times a week.

3) Other treatments

Infra-red was used with acupuncture treatment.

11. Clinical progression

1) Progress of treatment

On December 19, 2018, the adduction of Rt. eye was significantly impaired and diplopia was seriously appealed on the gaze to the left. However, on January 28, 2019, the distance of Rt. eye movement increased and diplopia symptoms were alleviated so the patient was able to walk without wearing an eye patch. On February 27, 2019, the distance of rightward movement increased compared to the end of January, but the rate of improvement was slower than the beginning of treatment, and diplopia remained similar. On March 22, 2019, As Rt. eye movement and diplopia were improved, the discomfort was almost lost when looking near, but the patient still complained of diplopia when he looking far. On April 5, compared with March 22, Rt. eye movement was similar, but diplopia was slightly improved.

IV. Discussion

Strabismus is a condition in which the eyes do not properly align with each other when looking at an object. That is, the right and the left collimation axes does not face the same point⁹⁾. In previous epidemiological research, 4% of the total population has these symptoms.

Strabismus is divided into paralytic strabismus and non-paralytic strabismus depending on the presence or absence of oculomotor paralysis. Paralytic strabismus is classified into lateral rectus paralysis, medial rectus paralysis, superior rectus paralysis, inferior rectus paralysis, inferior oblique paralysis and superior oblique paralysis. If one or both eyes turns inward, it is called esotropia.

Table 1. Progress of Adduction Deficit

Date	Nose to Rt. pupil	Rt. ext. angle to Rt. pupil	Date	Nose to Rt. pupil	Rt. ext. angle to Rt. pupil
2018.12.19	34mm	14mm	2019.01.28	28mm	20mm
2018.12.24	34mm	14mm	2019.02.15	27mm	21mm
2018.12.31	31mm	17mm	2019.02.27	26mm	22mm
2019.01.07	30mm	18mm	2019.03.13	25mm	23mm
2019.01.14	28mm	20mm	2019.03.22	23mm	25mm
2019.01.21	28mm	20mm	2019.04.05	23mm	25mm

Table 2. Change of Symptom and Progress

Date	Diplopia	Date	Diplopia
2018.12.19	severe+++	2019.02.27	moderate++
2019.01.07	severe+++	2019.03.13	mild+
2019.01.28	moderate++	2019.03.22	mild+
2019.02.15	moderate++	2019.04.05	mild+

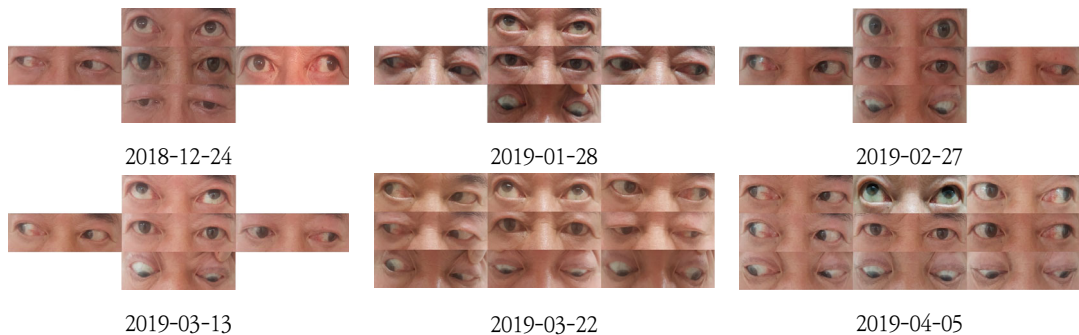


Fig. 1. Progress of Eye Movement

If one or both eyes are deviated outward, it is called exotropia. Hypertropia is a condition that the visual axis of one eye is higher than the fellow fixating eye, and hypotropia is the similar condition that the visual axis of one eye is lower¹⁰⁾.

Paralytic strabismus is divided into complete paralysis and incomplete paresis depending on the degree of paralysis. The causes include lesions of the extraocular muscles themselves or nerve paralysis. Lesions of the extraocular muscles include various physical trauma such as orbital fracture, physical impairment of eye movement due to scar formation caused by repeated muscle operations, muscle degeneration, infection, diabetes, peripheral nerve lesions due to trauma, and nucleus & nuclear lesions caused by encephalitis or cerebrovascular circulation disorder^{2,3,9)}.

The extraocular muscles consist of four rectus muscles and two oblique muscles, and there are three cranial nerves involved in the extraocular muscles. Trochlear nerve, the 4th cranial nerve works on Superior Oblique muscle. Abducens nerve, the 6th cranial nerve adjusts external rectus muscle. Oculomotor nerve, the 3rd cranial nerve controls the rest of extraocular muscle. The 3rd, 4th, and 6th cranial nerves are paralyzed by various causes and are known to have various clinical manifestations of paralysis. According to reports, the overall incidence of the cranial nerve paralysis was abrupt in the abducens nerve, followed by oculomotor nerve and trochlear nerve²⁾.

Oculomotor nerve is the 3rd cranial nerve

that controls the rest of extraocular muscles except for the lateral rectus and superior oblique. It controls the eye movement and the contraction of the pupil¹¹⁾. Oculomotor nerve palsy is caused by congenital or head trauma, vascular disease, aneurysm, tumor, diabetes, inflammatory disease, etc. The nucleus of the oculomotor nerve is located in the midbrain, so midbrain damage such as infarction, hemorrhage, and tumors can cause nerve paralysis. If the midbrain is damaged, It may cause the symptoms related to the eye, and also cause headache, nausea, vertigo, vomiting, rigorous hemiplegia or tremor. However, depending on the area of damage to the midbrain, the oculomotor nerve palsy may occur without ataxia^{12,13)}. In the case of a single oculomotor nerve palsy, limited adduction, upshoot and downshoot movement and ptosis may occur. In addition, diplopia and visual impairment could appear. If the inner fibers of the nerve are damaged, the pupil expands and the light reflexes and the control reflexes would disappear. However, sympathetic light reflexes of the opposite eye would be normal^{11,12,14)}. In most cases, when the lesion occurs in the nerve nucleus or nerve fibers, bilateral ocular motility disorders such as ptosis or bilateral upward gaze disorder may occur. Therefore, when a complete or partial oculomotor nerve palsy occurs, it is thought to be caused by subarachnoid space, spongy area, aneurysm occurring in the posterior segment of the eye, tumor, inflammation or muscle disease, or peripheral neuropathy. In rare cases, however, some of

the neuromuscular complexes may be damaged, resulting in paralysis of some of the extraocular muscles dominated by oculomotor nerve, or if the nerve fibers are damaged while driving through the midbrain, only some of the nerve-dominated muscles are paralyzed¹⁵⁻¹⁷⁾. These partial paralysis occurring in some muscles are due to the three-dimensional arrangement of oculomotor nerve nuclei, and therefore, eye movement paralysis can occur in various forms¹⁸⁻²¹⁾.

This case is considered to be rare because this patient had paralytic strabismus without intracranial hypertension, rigorous hemiplegia, or ataxia, and also the cranial nerve is partially paralyzed so the discomfort only appears when he is gazing to the left.

Many books such as *Young Chu* or *Zhu Bing Yuan Hou Lun* mentioned the causes, types, features, characteristics, and treatments of strabismus. In Korean medicine, strabismus is caused by a lack of organ energy, which makes bad energy enter to the body and damage the eyes²⁾. Park et al⁵⁾ reviewed about causes and treatments of strabismus. In this review, strabismus is mainly caused by trauma, pathogenic energy or factors, metabolic waste, and lack of organ energy. The target and method of the treatment would be different depending on the diagnosis. For instance, If there is a disease caused by deficiency of the kidney and liver energy, the main treatment should be focused on reinforcing those organ energy. If metabolic waste is the problem, the treatment should focus on eliminating waste from the body.

This patient is 59-year-old male person with slightly obese body types. He suddenly developed diplopia on December 11, 2018, so he was hospitalized in the Neurology Department of General Hospital on December 12, 2018. He was diagnosed with midbrain infarction so he took the conservative treatment for 7 days. On December 19, 2018, He started Korean medical treatment.

Initially, the patient had limited Rt. eye movement so there was no voluntary Rt. eye movement from center to inside. As the patient's gaze moved from the right to the left, the diplopia phenomenon became apparent, making it impossible for the patient to walk without an eye patch on his Rt. eye.

The treatment was mainly performed in 2 ways, herbal medicine and acupuncture.

Herbal medicine treatment can be performed using Bianzheng Lunzhi - Korean medicine diagnosing tool - based on the comprehensive body condition. It also intended to recover the normal condition by removing pathogenic Qi and smoothly circulating the vital energy. If extraocular muscles are injured, *Huafengdan* could be chosen. In case of removing of metabolic waste, *zhengrongtang* could be used for strabismus²²⁾.

However, in this case, the patient was exposed to excessive drinking, constant overwork and stress. His personality was rapid and easily angered. His face and eyes were red, and his body was hot. He was also suffering from hypertension and hyperlipidemia so he was taking the medication.

Therefore, the perception of Korean medicine, this patient was judged to have a lot of heat in the liver so *Saengkankunbi-tang* is intended to remove the heat of the liver through urinating, and vitalize hyperactive liver. The patient took *Saengkankunbi-tang* 2 times a day for 17 days. After that, the patient didn't want any more herbal medicine treatment, so the treatment was suspended. Kim²³⁾ has made *Saengkankunbi-tang* for Liver function normalization through comforting stomach and spleen, smoothing urination, normalizing gall bladder function. A study reported by Hwang et al²⁴⁾ have shown that *Saengkankunbi-tang* has a significant effect in preventing hyperlipidemia caused by long-term alcohol administration, and the role of *Saengkankunbi-tang* in the management of hyperlipidemia can be also expected. However, it was difficult to observe the long-term effects of herbal medicines.

Based on the previous studies, neighboring acupuncture points or remote acupuncture points could be chosen for acupuncture treatment. In terms of using remote acupuncture point, Jung et al²⁵⁾ reported a case of exotropia treated by *Saam small intestine tonifying acupuncture*. Choi et al²⁶⁾ also reported a case of abducens nerve paralysis treated by *Saam stomach tonifying acupuncture*. In other cases, neighboring acupuncture points are also used for treatment²⁷⁾. BL1, GB1, ST2, TE23, GB41 are all located around the eyes and effective for eye dryness, pain, cloudy cornea and conjunctiva²⁸⁾. Additionally, electro-acupunctures could be

another option for treatment. Previous studies have used neighboring acupuncture points for electro-acupunctures but recent studies suggest to perform electro-acupunctures directly on paralyzed ocular muscles²⁹⁻³¹⁾. In this study, LI4, ST1, EX-HN4, GB1, TE23, BL2, GB20 are used to help the circulation of Qi and blood around the eyes.

On December 19, 2018, the adduction range was significantly impaired to 14mm in the Rt. eye movement. The patient appealed severe diplopia when gazing to the left. However, on January 28, 2019, the distance of Rt. eye movement increased to 20mm and diplopia symptoms are relieved to moderate so the patient was able to walk without wearing an eye patch. On February 27, 2019, the distance of rightward movement increased to 22mm but the rate of improvement was slower than the beginning of treatment, and diplopia remained similar. On March 22, 2019, As Rt. eye movement and diplopia were improved, the discomfort was almost lost when looking near, but the patient still complained of diplopia when looking far. The distance of rightward movement increased to 25mm. On April 5, compared with March 22, Rt. eye movement was similar, but diplopia was slightly improved.

In conclusion, during 15 weeks of treatment, the range of adduction of the Rt. eye was continuously increased through the Korean medicine treatment, and the moving distance of the Rt. eye increased by 11mm compared to the initial treatment and the diplopia symptoms also improved.

Through this case, we can confirm that Korean medicine treatment is helpful for the improvement of paralytic strabismus caused by midbrain infarction, which suggests the possibility that a good progress can be expected when Korean medicine treatment is attempted for symptoms of oculomotor nerve palsy. However, it is difficult to generalize the treatment effects of this case because there is only one case and the treatment was not completed. The overall results were thought to be contributed mainly by acupuncture treatment, as herbal medicine was administered only in the early stages of treatment. More case reports and systematic research such as RCTs are expected to be needed in the future.

V. Conclusion

In this study, we reported a case of paralytic strabismus caused by midbrain infarction. The patient was treated with Korean medicine and the symptomatic improvement was confirmed without any side effects. Therefore, it can be used as a basis for the Korean medical treatment and research of paralytic strabismus in the future.

ORCID

Se-Hee OH

(<https://orcid.org/0000-0003-2656-1896>)

Seung-Ug Hong

(<https://orcid.org/0000-0002-6228-3312>)

References

1. Lee YS, Park MS, Shin CS, Lee KR, Choi SM, Lee SH, et al. A case of isolated abducens nerve palsy caused by vascular compression. *J Korean Neurol Assoc.* 2006;24(6):628-9.
2. Noh SS. *Oriental Ophthalmology & Otorhinolaryngology.* 3rd edition. Seoul: IBC Inc. 2007:281-98.
3. Yoon DH, Lee SW, Choi Y. *Ophthalmology.* 4th edition. Seoul:IlChoGak. 1996:223-45.
4. Kim KB, Kim DK, Kim YH, Kim JH, Min SY, Park EJ. *Oriental Pediatrics.* Seoul:EuiSungDang. 2010:927-9.
5. Park EJ, Shin SY. A Literature Review on pediatric strabismus~A Comparison of East-West Medicine~. *The Journal of Korean Oriental Pediatrics.* 1996;10(1): 35-76.
6. Jeung SM, Kim SJ, Jeung JA, Ann JJ, Jeon SY, Hong S, et al. A Case of the Oculomotor Nerve Palsy in Benedict's Syndrome Patient. *Korean J.Orient.Int. Med.* 2005;26(3):670-6.
7. Jung KH, Kim MS, Hwang HS, Jeon JC, Park JY, Lee TH, Lee EY, et al, Case Report of Three Cases of Idiopathic Oculomotor Nerve Palsy Treated with Hominis Placenta Pharmacopuncture. *Journal of Pharmacopuncture.* 2009;12 (1):91-7.
8. Rhee JH, Kim YE, Kim IW, Lee KS, Lee SG, Case of Monocular partial oculomotor nerve palsy In a patient with Midbrain and Thalamus Hemorrhage. *Journal of*

- physiology & pathology in Korean Medicine. 2010;24(2):333-7.
9. Chae BY. Oriental Ophthalmology & Otorhinolaryngology. Seoul:JipMunDang. 1994:130-44.
 10. Ahn HS, Hong CE. Textbook of Pediatrics. 9th edition. Seoul:Daehan Textbook Publishers. 2007:1191-3.
 11. Stephen G. Waxman. Correlative Neuroanatomy. Seoul:HanWooRi. 1998:121-2
 12. The Korean Neurosurgical Society. Neurosurgery. 2nd edition. Seoul:JungAng-MunWhaSa. 2002:22-6.
 13. Lindsay KW, Bone lan. Neurology and Neurosurgery illustrated. 3rd edition. Seoul:BumMunSa. 2002:230-56.
 14. Biousse V, Newman NJ. Third Nerve palsies. Semin Neurol. 2000;20(1):55-6
 15. Pusateri TJ, Sedwick LA, Margo CE. Isolated inferior rectus muscle palsy from a solitary metastasis to the oculomotor nucleus. Arch Ophthalmol. 1987;105(5):675-7.
 16. Warren W, Burde RM, Klingele TG, Roper-Hall G. Atypical oculomotor paresis. J Clin Neuroophthalmol. 1982;2(1):13-8.
 17. Shin WC, Rhee HY, Lee HK, Lee TG, Chang DI, Chung KC. Two Cases of Partial Oculomotor Nerve Palsy due to Midbrain Infarction. Journal of the Korean Neurological Association. 2000;18(1):80-4.
 18. Tezer I, Dogulu CF, Kansu T. Isolated inferior rectus palsy as a result of paramedian thalamopeduncular infarction. J Neuroophthalmol. 2000;20(3):154-5.
 19. Takano M, Aoki K. Midbrain infarction presenting isolated inferior rectus nuclear palsy. Rinsho Shinkeigaku. 2000;40(8):832-5.
 20. Negoro K, Sasabe F, Morimatsu M. Isolated inferior rectus muscle paresis from midbrain infarction. Rinsho Shinkeigaku. 1993;33(4):434-6.
 21. Chou TM, Demer JL. Isolated inferior rectus palsy caused by a metastasis to the oculomotor nucleus. Am J Ophthalmol. 1998;126(5):737-40.
 22. The Society of Korean Medicine Ophthalmology, Otolaryngology, Dermatology. Korean Medicine Ophthalmology & Otolaryngology & Dermatology. Paju: Globooks. 2019:193-4.
 23. Kim BW. Clinical Analysis and the Effect of Saengkankunbi-tang on 3,136 Cases of the Chronic Hepatitis Patients. Journal of Korean Medicine. 1993;14(1):216-23.
 24. Hwang SJ, Choi HS, Kim SM, Woo CH. Effects of Saengkankeonbi-tang on Prevention of Hyperlipidemia and Liver Damage Induced by Alcohol. Kor. J. Herbology. 2004;24(4):9-15.
 25. Jung KS, Park HJ, Kim SH, Ahn HJ, Ock MK. A Clinical Study on One Case of Exotropia Caused by Unilateral-internuclear-ophthalmoplegia due to Pontine Infarction. The Journal of Korean Acupuncture & Moxibustion Society. 2006;23(3):241-7.
 26. Choi AR, Ha JH, Lee JH, Jang WS, Goo DM. A Clinical Study on Strabismus Patient of Abducence Nerve Paralysis in Soyangin Improved with Yangkyuksanhwa-tang. J of

- Sasang Constitutional Medicine. 2008;20(3):176-83.
27. Lee JN, Lee SH, Lee JY. Recent Clinical Research on Effect of Acupuncture for Strabismus. J Pediatr Korean Med. 2016;30(2):23-30.
 28. Lee CW, Lee EK, Jeon JH, Kim JH, Kim YI, Kim JI. Effects of acupuncture therapy on dry eye syndrome: 43 case series. Journal of Korean Acupuncture & Moxibustion Society 2010;27(6):85-94.
 29. Han JS, Won JY, Kim MJ, Choi JE. The One Case Report of Strabismus of Traffic Accident Induced Abducence Nerve Paralysis Treated with Electro-acupuncture. Journal of Korean Medicine Rehabilitation. 2015;25(3):111-7.
 30. Kim NK, One case of paralytic strabismus (oculomotor nerve palsy) which was treated electroacupuncture at oculomotor muscles. J Korean Med Ophthalmol Otolaryngol Dermatol. 2006;19(3):232-6.
 31. Kim NK, One case of traffic accident induced paralytic strabismus(oculomotor nerve palsy) which was treated with electroacupuncture at oculomotor muscles. J Korean Med Ophthalmol Otolaryngol Dermatol. 2008;21(1):133-8.