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NON-SURGICAL CORRECTION OF LONG-STANDING CONCOMITANT STRABISMUS

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Long-standing concomitant strabismus in childhood is often accompanied by functional complications, including functional suppression scotoma, also known as binocular haploscopic suppression, which interferes with binocular vision restoration and reduces the effectiveness of diploptic treatment. We present the case of a 15-year-old boy with esotropia and functional suppression scotoma. Comprehensive ophthalmological examination included assessment of ocular motility, prism-cover testing, and evaluation of binocular vision using a synoptophore and the special computerized diagnostic and therapeutic program. Initial best-corrected visual acuity was 0.9 in the right eye and 0.8 in the left eye, with esotropia of 30 PD without correction and 15 PD with correction. After a 10-day course of orthoptic therapy, haploscopic binocular vision was restored and the deviation angle decreased. Following diploptic therapy one month later, normal binocular vision with correction was achieved. One year later, orthotropia and stable normal binocular vision were maintained without surgical intervention.

Key words: concomitant strabismus, functional suppression scotoma, binocular haploscopic suppression, haploscopic binocular vision, orthoptic therapy, diploptic therapy.

Зульфієв Г.Г.

НЕХІРУРГІЧНА КОРЕКЦІЯ ДОВГОТРИВАЛОЇ СПІВДРУЖНЬОЇ КОСООКОСТІ

Тривалий содружній косоокість, що розвинувся в дитячому віці, часто супроводжується функціональними ускладненнями, зокрема функціональною скотомою пригнічення, або бінокулярним гаплоскопічним пригніченням, що перешкоджає відновленню бінокулярного зору та знижує ефективність диплоптичного лікування. Представлено клінічний випадок 15-річного підлітка з езотропією та функціональною скотомою пригнічення. Комплексне офтальмологічне обстеження включало оцінку функції окорухових м'язів, призматичний cover-тест, а також дослідження бінокулярного зору за допомогою синоптофора та спеціалізованої комп'ютерної діагностично-лікувальної програми. На початку спостереження максимально скоригована гострота зору становила 0,9 на правому оці та 0,8 на лівому, кут езотропії – 30 призмних діоптрій без корекції та 15 призмних діоптрій із корекцією. Після 10-денного курсу ортоптичного лікування відновився гаплоскопічний бінокулярний зір і зменшився кут девіації. Після курсу диплоптичної терапії, проведеного через місяць, було досягнуто нормального бінокулярного зору з корекцією. Через один рік зберігалися ортотропія та стабільний нормальний бінокулярний зір без хірургічного втручання.

Ключові слова: співіснуюча косоокість, функціональна скотома пригнічення, бінокулярне гаплоскопічне пригнічення, гаплоскопічний бінокулярний зір, ортоптичне лікування, диплоптична терапія.

One of the most common eye diseases in children is strabismus [1, 4, 5]. The period when strabismus, a disease of the eyeball's motor apparatus, occurs most often coincides with the development of the visual system and the formation of binocular vision. When the mentioned pathology is detected, treatment should be started as soon as possible. Otherwise, further increase in visual tension during school years leads to the deepening of this disorder and the emergence of additional complications [3, 6, 10]. Thus, failure to treat strabismus in a timely manner leads to a permanent loss of the ability to achieve binocular vision, unilateral or bilateral decreasing of vision, and the development of amblyopia.

One of the complications resulting from the delay in the treatment of strabismus is functional suppression scotoma (FSS) or binocular haploscopic suppression (BHS) [2, 15].

In persistent strabismus, the brain begins to suppress visual information from one eye to eliminate double vision. As a result, occurs pathological suppression, which is an adaptation of the visual brain to prevent confusion and diplopia during strabismus. For eliminating double vision, the brain creates a "blind spot" - pathological suppression in the visual field of one eye. Pathological suppression is a protective mechanism of the central nervous system that is difficult to treat and prevents the restoration of normal binocular vision (NBV). This is a temporary "shutdown" of visual information from one eye to create visual comfort, without actual damage to the retina [9, 11, 13].

Under natural conditions, pathological suppression is present in all cases of concomitant strabismus; otherwise, diplopia would occur. Thus, when manifest strabismus and normal retinal correspondence are present without diplopia, pathological suppression has developed [7, 8, 12]. However, detection of pathological suppression using haploscopic devices depends on the severity of binocular disruption and may not be identified in all cases of concomitant strabismus. Diplopia, which causes pathological suppression in natural conditions, is eliminated by providing bifoveal fixation in haploscopic devices. In this case, haploscopic binocular vision (HBG) is formed in eyes whose binocular relations are not very deeply disturbed. However, sometimes pathological suppression causes more profound disturbances. As a result, HBG is not obtained, which is a sign of BHS or FSS.

Orthoptic exercises play a significant role in eliminating pathological suppression. Nevertheless, the presence of FSS represents a major obstacle to both diploptic therapy and restoration of binocular vision, including in the postoperative period. Therefore, timely diagnosis and elimination of FSS using specialized training on appropriate devices directly affect the effectiveness of both non-surgical and surgical treatment modalities [11, 14].

The purpose of the study was to demonstrate the importance of eliminating functional suppression scotoma, one of the complications resulting from long-standing strabismus, in the successful management of strabismus.

Materials and methods. The study was conducted on the basis of Azerbaijan Medical University from March 2024 till Aprile 2025. A 15-year-old schoolboy with long-standing esotropia, unresponsive to prolonged optical and pleoptic treatment, presented to Educational-Surgical Clinic of Azerbaijan Medical University (Baku, Azerbaijan) for surgical correction. Strabismus had first been detected 12 years earlier. During this period, appropriate hypermetropic correction was prescribed and mild amblyopia was treated. However, even under full correction, complete orthotropia was not achieved, and a residual esotropia of 12 PD persisted.

The patient's visual acuity was assessed with and without correction, and static refraction was determined. The motility of the extraocular muscles, that move the eyeball was evaluated. The deviation angle was measured at near and distance using the prism-cover tests. The objective angle of deviation was assessed using a synoptophore (Inami, Japan). The subjective angle of deviation and presence of HBV were evaluated using both the synoptophore and the special computerized diagnostic and therapeutic program. During synoptophore examination, haploscopic fusion could not be achieved; stereoscopic images moved past each other without fusion. This phenomenon was interpreted as the presence of FSS, and the point of image crossover was considered the degree of FSS. Similarly, during examination with the computer program, the point at which images crossed without formation of HBV was identified as the location of FSS.

A 10-day course of treatment aimed at eliminating FSS and establishing HBV was initiated. After a one-month interval, a second diploptic treatment course was prescribed to consolidate HBV and restore NBV. Follow-up examinations were conducted at the end of each treatment course and at 1 month, 3 months, and 1 year thereafter.

Treatments aimed at eliminating BHS and establishing binocular vision were carried out on the synoptophore and the special computer program. The synoptophore was adjusted to the patient's interpupillary distance, and the arms of the apparatus were brought to the FSS point determined in the patient. The lights of the stereoscopic images on the arms of the synoptophore were set to alternately automatically blink and flash. The alternation speed was low in the first days, and gradually increased each day. The treatment procedure was prescribed for 20 minutes every day for 10 days. At the end of each daily treatment, an examination of the HBG was performed. During the course of treatment, the patient used full cycloplegic hypermetropic correction.

Treatment was initiated on the first day, following a 30-minute interval after the preceding orthoptic procedure. Daily 15-minute sessions were performed under appropriate hyperopic correction using red-green anaglyph glasses. Dichoptic visual stimulation was applied by presenting complementary red and green targets at the predetermined location of the functional suppression scotoma in an alternating flicker mode to reduce suppression and restore binocular interaction. Haploscopic binocular vision was assessed at the end of each treatment session.

This study presents a clinical case and was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki (latest revision) and the Council of Europe Convention on Human Rights and Biomedicine (Oviedo Convention). All diagnostic and therapeutic procedures were performed as part of routine clinical practice. The principles of voluntary participation, patient confidentiality, and personal data protection were strictly observed.

Written informed consent was obtained from the patient's legal representative, and assent was obtained from the patient, for diagnostic and therapeutic procedures and for the anonymous publication of clinical data. No personally identifiable information is disclosed in this report.

Results of the study. The patient's distance visual acuity examination revealed uncorrected distance visual acuity of 0.4 in both eyes.

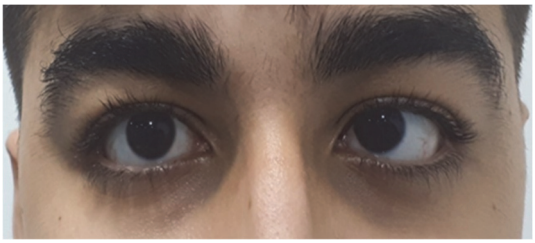
BCVA OD=0.9; BCVA OS=0.8.

Static refraction showed moderate hypermetropia with astigmatism:

ROD=Sph.+4.0D Cyl.+1.0D ax180;

ROS=Sph.+4.5D Cyl.+1.0D ax180.

Extraocular muscle motility was normal in all diagnostic gaze directions. Deviation angles were measured with and without correction at near and distance. The results of strabometry did not depend on whether the examination was near or far, and different results were obtained depending on the correction (Fig.1).



A

B

Fig. 1. Before treatment (A, B).

As can be seen, Hypermetropic correction reduced the deviation angle, but a residual esotropia of 12 PD persisted in the prism-cover test. BHS was detected during subjective angle assessment using both examination methods: synoptophore and the computer program. The Worth four-dot test revealed monocular vision under all conditions (Table 1).

Table 1

The results of the Worth four-dot test of the patient

Examination	Optic. Corr.	On admission	End of 1st course	End of 2nd course	After 1 month	After 3 months	After 1 year
Prizm Cover test	Without	ET 30 PD	ET 25 PD	ET 20 PD	ET 15 PD	ET 15 PD	ET 10 PD
	With	ET 12 PD	ET 6 PD	0 PD	XT 15 PD	O=O	O=O
Objective angle	Without	ET 35 PD	ET 25 PD	ET 20 PD	ET 15 PD	ET 15 PD	ET 10 PD
	With	ET 12 PD	ET 12 PD	ET 6 PD	0 PD	ET 4 PD	ET 4 PD
Subjective angle	Without	Func/scotom ET 30 PD	ET 20 PD	ET 20 PD	ET 15 PD	ET 15 PD	ET 10 PD
	With	Func/scotom ET 10 PD	ET 10 PD	O=O	XT 8 PD	O=O	O=O
Special computer program	Without	Func/scotom ET 24 PD	ET 12 PD	ET 10 PD	ET 10 PD	ET 10 PD	ET 6 PD
	With	Func/scotom ET 18 PD	ET 4 PD	0 PD	XT 5 PD	0 PD	0 PD
Worth, distant	Without	OS-suppression	OS-suppression	OS-suppression	OS-suppression	OS-suppression	OS-suppression
	With	OS-suppression	OS-suppression	Diplopia	Diplopia	Diplopia	Diplopia
Worth, Near	Without	OS-suppression	OS-suppression	Diplopia	Diplopia	Diplopia	Binocular
	With	OS-suppression	Diplopia	Binocular	Binocular	Binocular	Binocular

In order to eliminate functional scotoma, a 10-day treatment course of orthoptic exercises was started on the synoptophore and the special computer program. On the 6th day of the treatment course, HBV was obtained during the synoptophore examination, which means that the FSS was eliminated. The point where HBV was obtained, that is, the degree of the subjective deviation angle, corresponded to the point where FSS was (10PD) and almost did not differ from the size of the objective angle (12PD). The presence of HBG was constant on the following days of treatment. On the 8th day of treatment, FSS disappeared on the special computer program and was not determined in any case on the following days. At the end of the 10-day treatment course, FSS was eliminated, the deviation angle determined on the synoptophore and the computer program decreased. Diploptic binocular vision was obtained in the Worth test with correction at near examination. A re-examination after a 1-month break revealed the recurrence of FSS. A second course of treatment was prescribed, and on the second day of the course, FSS disappeared in both examination methods, and the presence of HBV was detected. In the following days of the course, treatment was continued with diploptic exercises in both devices to eliminate minor deviations (8PD in synoptophor, 6PD in KP). At the end of the second course of treatment, the angle of squint decreased in all examinations without correction, and disappeared with correction. NBV was obtained in the Worth test at near range with correction, and diploptic vision was obtained in the uncorrected near and far distance examinations with correction.

At the examination 1 month after the 2nd treatment course, exotropia was observed in the patient under full cycloplegic correction, so the power of hyperopic glasses correction was reduced by 1.0 D. At the examination 3 months later, orthotropia with correction and ET 15PD without correction were seen.

The patient was re-examined 1 year after the second course of treatment:

UCVA OU=0.6;

BCVA OU=0.9.

Static refraction examination showed a slight decrease in the degree of hyperopia:

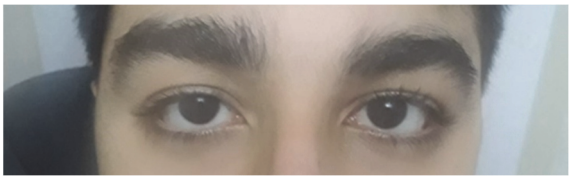
ROD=Sph.+3.5D Cyl.+1.0D ax180;

ROS=Sph.+3.75D Cyl.+1.0D ax180.

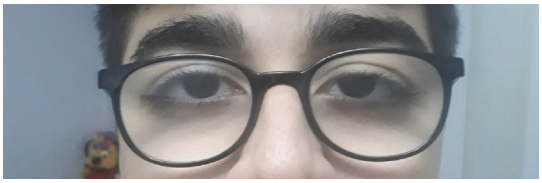
Result of prism-cover test: with correction = orthotropia; without correction: ET 10 PD.

NBV was obtained at near distance without correction and with correction, and diploptic binocular vision was obtained at far distance with correction (Fig. 2).

Discussion. As mentioned, delaying the treatment of concomitant strabismus leads to complications such as amblyopia, eccentric fixation, and persistent sensory adaptations that reduce the likelihood of successful binocular vision restoration [5, 6, 10]. Epidemiological studies have demonstrated that strabismus remains one of the leading causes of binocular vision disorders in childhood, with amblyopia being the most frequent associated condition [1, 13, 16]. Current consensus statements also emphasize that early diagnosis and timely treatment are essential for preventing irreversible sensory disturbances and improving long-term visual outcomes [11].



A



B

Fig. 2. After treatment (A, B).

One of the major functional obstacles to successful treatment is the development of functional suppression scotoma. Clinically, this condition is characterized by the absence of diplopia during prism testing and the inability to achieve haploscopic binocular vision (HBV) despite appropriate optical correction. Although recent reviews have highlighted significant advances in the diagnosis and treatment of binocular vision anomalies, persistent suppression remains an important therapeutic challenge because it limits binocular fusion and stereopsis even when ocular alignment is satisfactory [2].

Our experience also suggests that FSS is a clinically significant sensory disorder not only in non-accommodative but also in accommodative strabismus. Restoration of motor alignment alone does not necessarily result in normal binocular vision if suppression persists. This observation is consistent with contemporary concepts of strabismus management, which emphasize that successful treatment should address both motor and sensory components of the disorder [2, 9].

Eliminating FSS as early as possible facilitates restoration of HBV and creates favorable conditions for the subsequent development of stable normal binocular vision. Repeated examinations within one month after HBV restoration are advisable because newly established binocular interactions are initially fragile and susceptible to disruption. Timely repeated courses of orthoptic and diploptic therapy strengthen these sensory connections and may ultimately lead to stable normal binocular vision, as demonstrated in the present case.

Although surgical correction remains an effective treatment for many patients with horizontal strabismus, satisfactory ocular alignment alone does not always guarantee functional binocular recovery [7, 15]. Our clinical observation indicates that elimination of suppression before considering surgery, or during postoperative rehabilitation, may improve sensory outcomes and contribute to more stable long-term results.

The one-year follow-up demonstrated sustained orthotropia and stable normal binocular vision while wearing the appropriate hyperopic correction, emphasizing the importance of continuous optical correction and long-term follow-up in maintaining treatment success [11].

Conclusion

Long-standing concomitant strabismus is frequently associated with sensory adaptations that reduce the likelihood of successful binocular vision restoration. Functional suppression scotoma, or binocular haploscopic suppression, represents one of the most significant functional barriers to treatment, as it prevents the development of stable binocular interaction despite adequate optical correction. The present clinical case demonstrates that targeted elimination of FSS through orthoptic and diploptic rehabilitation can restore haploscopic binocular vision, reduce the angle of deviation, and achieve stable orthotropia with normal binocular vision without surgical intervention in selected patients. These findings emphasize the importance of identifying and treating functional sensory complications as an integral component of comprehensive strabismus management. Addressing FSS before considering surgery may improve treatment outcomes, enhance postoperative binocular function when surgery is required, and contribute to the long-term stability of the therapeutic effect.

Prospects for further research. Further studies involving larger patient cohorts are warranted to evaluate the long-term effectiveness of targeted suppression elimination and to establish standardized treatment protocols for patients with concomitant strabismus and functional suppression scotoma.

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CLINICAL SYMPTOMATOLOGY, DIAGNOSIS, MORPHOLOGICAL STRUCTURE, AND MANAGEMENT OF CEMENTOMAS

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Clinicians classify cementoma – a tumor of mesenchymal origin tightly associated with tooth roots – as a variant of odontomas. Conversely, pathomorphologists consider cementomas to be lesions of both neoplastic and dysembryogenetic nature, the common feature of which is the presence of cementum-like tissue in the apical region. We analyzed a clinical case of a mandibular cementoma in the region of tooth 36, detected radiographically in a patient referred by an orthodontist for a consultation regarding the extraction of the follicles of other teeth. The clinical scenario and the definitive diagnosis, given certain discrepancies in the nosological classification of cementomas, prompted us to analyze the literature and summarize our own clinical observations regarding this pathology. The obtained results allowed for the determination of the clinical, diagnostic, and morphological features of specific types of cementomas listed in the WHO International Histological Classification of Tumors, as well as their management strategies. The features distinguishing cementomas from clinically similar pathological processes are presented. Particular attention is paid to condensing osteitis, a variant of chronic apical periodontitis that develops in response to prolonged inflammation.

Key words: cementoma, odontoma, hypercementosis, osteosclerosis, condensing osteitis.

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КЛІНІЧНА СИМПТОМАТИКА, ДІАГНОСТИКА, МОРФОЛОГІЧНА СТРУКТУРА ТА ЛІКУВАННЯ ЦЕМЕНТОМ

До різновидів одонтом клініцисти відносять цементому – пухлину мезенхімального походження, інтимно пов'язану із коренями зубів. Натомість патоморфологи вважають цементоми ураженнями як пухлинної, так і дизембріогенетичної природи, загальною ознакою яких є наявність цементоподібної тканини в апікальній ділянці. Нами проаналізовано клінічний випадок цементоми нижньої щелепи в ділянці 36 зуба, виявленої рентгенологічним дослідженням у пацієнта, направленого ортодонтом на консультацію з приводу видалення фолікулів інших зубів. Клінічна ситуація та остаточний діагноз із урахуванням деяких розбіжностей у визначенні нозологічної приналежності цементом спонукали нас до аналізу літературних даних із узагальненням власних клінічних спостережень щодо зазначеної патології. Отримані результати дозволили визначити клінічні, діагностичні і морфологічні особливості окремих видів цементом, наведених у Міжнародній гістологічній класифікації пухлин ВООЗ, та лікувальну тактику. Представлено ознаки, що відрізняють цементоми від клінічно схожих патологічних процесів. Окрема увага приділена конденсованому оститу як варіанту хронічного апікального періодонтиту у відповідь на тривале запалення.

Ключові слова: цементома, одонтома, гіперцементоз, остеосклероз, конденсований остит.

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Odontomas are relatively common entities encountered by oral and maxillofacial surgeons, including pediatric specialists, in the course of providing specialized medical care. Their diagnosis, the choice of treatment strategies and surgical techniques, and the prevention of recurrences and potential complications can sometimes present significant challenges and professional dilemmas, even for experienced specialists [2, 12].

The majority of the contemporary medical community recognizes that odontomas are classified as hard or soft, depending on the types