ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Prevalence of Childhood Eye Diseases

Çocukluk Yaş Grubunda Göz Hastalıkları Prevalansı

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ABSTRACT Objective: Population or hospital-based studies of the epidemiology of childhood eye diseases in Turkey are limited. Therefore, we aimed to establish the eye disease and treatment frequencies in a cohort of children presenting to a single pediatric ophthalmology clinic in Istanbul. **Material and Methods:** This was a retrospective review of the hospital files of 500 children admitted to the pediatric ophthalmology clinic of Atakoy Dunyagoz Hospital with eye complaints between January 2016 and July 2017. **Results:** The female to male ratio in the study cohort was 1:1. Of these patients, 38.6% were 0-5 years old, 31.6% were 6-11 years old, and 29.8% were 12-18 years old. Out of 500 children, 483 (96.6%) were diagnosed with one or more eye diseases. A refractive error was the most prevalent eye disease, which was recorded in 434 patients (86.6%), followed by conjunctivitis (24.4%), strabismus (11.8%), amblyopia (9.2%), and glaucoma (8.0%). There were no significant differences between the male and female patients in terms of prevalences of any of the eye diseases. The children who were 6–11 years old had remarkably lower prevalences of refractive errors (70.3%) and amblyopia (3.2%) than the children that were 0–5 years old and 12–18 years old ($p<0.05$). The treatments administered for these eye diseases included, in the order of frequency, eyeglasses, medication, occlusion therapy, contact lenses, and strabismus operations. **Conclusion:** Refractive errors, conjunctivitis, strabismus, and amblyopia were the diseases most commonly encountered in the pediatric ophthalmology clinic daily practice. Increasing the public's knowledge and raising awareness is crucial for better and earlier management of childhood eye diseases.

Keywords: Hospital records; cross-sectional studies; refractive errors; childhood eye diseases; prevalence

ÖZET Amaç: Türkiye'de çocukluk çağı hastalıklarının epidemiyolojisi üzerine yapılan nüfus veya hastane tabanlı çalışmalar sınırlıdır. Bu çalışmada İstanbul'da tek bir pediatrik oftalmoloji kliniğine başvuran bir çocuk hasta grubunda göz hastalıkları ve tedavilerinin sıklığını sunmayı amaçladık. **Gereç ve Yöntemler:** Ocak 2016 ve Temmuz 2017 tarihleri arasında Ataköy Dünyagöz Hastanesi pediatrik oftalmoloji kliniğine göz şikayeti ile başvuran 500 çocuğun hastane dosyaları retrospektif olarak incelendi. **Bulgular:** 500 çocuğun çalışma kohortunda kız-erkek oranı 1: 1 idi. Çocukların %38,6'sı 0-5 yaş, % 31,6'sı 6-11 yaş, %29,8'i 12-18 yaş aralığındaydı. 500 çocuktan 483'üne (%96,6) bir veya daha fazla göz hastalığı teşhisi kondu. Kırma kusuru 434 hastada (%86,6) en sık görülen göz hastalığıydı; takiben konjonktivit (%24,4), şaşılık (%11,8), ambliyopi (%9,2) ve glokom (%8,0) tespit edildi. Herhangi bir göz hastalığının görülme sıklığı açısından erkek ve kız hastalar arasında anlamlı fark yoktu. 6-11 yaş grubundaki çocuklarda kırma kusurları (%70,3) ve ambliyopi prevalansı (%3,2) 0-5 yaş ve 12-18 yaş arasındaki çocuklara göre belirgin olarak daha düşüktü ($p<0,05$). Tespit edilen göz hastalıkları için uygulanan tedaviler, sıklık sırasına göre gözlük, ilaç tedavisi, kapama, kontakt lens ve şaşılık ameliyatıydı. **Sonuç:** Pediatrik oftalmoloji kliniklerinde günlük uygulamalarda karşılaşılan en sık rastlanan hastalıklar kırma kusurları, konjonktivit, şaşılık ve ambliyopidir. Çocukluk göz hastalıklarının erken tanı ve tedavisi için toplumun bilgi ve bilinç düzeyini arttırmak hayati öneme sahiptir.

Anahtar Kelimeler: Hastane kayıtları; kesitsel çalışmalar; kırma kusurları; çocukluk çağı göz hastalıkları; prevalans

Vision is essential to a child's development and quality of life. Almost three-fourths of a child's learning is accomplished through vision.[1] The World Health Organization (WHO) estimates that 19 million children worldwide are affected by visual impairments, mainly caused by uncorrected refractive errors, followed by untreated cataracts and glaucoma.[2,3] A medical consultation is very important for preventing visual impairments and providing the correct treatment. Over 80% of all visional impairments can be prevented or cured.[3]

Eye diseases and visual impairments can cause social and economic difficulties, particularly in developing countries.[3] Children in developing countries suffer from blindness almost four times more often than children in developed countries.[4-6] Therefore, eye diseases in children should be prioritized, especially in developing countries such as Turkey. Unfortunately, population-based and hospital-based studies on the epidemiology of childhood eye diseases in Turkey are limited. In one cross-sectional study conducted in Turkey, 12.4% of the children were reported to have decreased visual acuity.[7] Another study indicated that children who were exposed to health problems in Turkey had visual problems at a prevalence of 13.6%.[8] Moreover, the myopia rate varied between 16.1% and 16.5% in children in grades 4 and 5 in a school-based vision screening study.[9] Further identification of the eye diseases encountered in pediatric ophthalmology clinics based on the age groups, as well as the treatment approaches, will improve the management of children's eye diseases in Turkey.

Based on the information above, we aimed to present the eye disease and treatment frequencies in a cohort of children presenting to a single pediatric ophthalmology clinic in Istanbul, Turkey.

MATERIAL AND METHODS

STUDY DESIGN AND POPULATION

This was a retrospective review of the hospital files of 500 children admitted to the pediatric ophthalmology clinic of Atakoy Dunyagoz Hospital with eye complaints between January 2016 and July 2017. Those patients with incomplete ophthalmological evaluations and cycloplegic refractions data, and those not examined by pediatric ophthalmologists were excluded from this study. Because this was a screening study, no other exclusion criteria were defined. The data was evaluated with respect to the children's genders (male and female) and ages (0-5 years old, 6-11 years old, and 12-18 years old).

This study was approved by the Institutional Ethics Committee of Bahcesehir University in Istanbul, Turkey (November 1, 2017; 2017-17/01), and it was conducted in accordance with the Declaration of Helsinki. The patients' informed consent requirement was waived on the basis of the current legislation of the Ministry of Health (Regulation on Clinical Investigations of Drugs and Biological Products, 13/9/2015; Observational Drug Research Guide, 29/08/2014) and Turkish Personal Data Protection Law no. 6698 article 28c (7/4/2016).

DIAGNOSTIC CRITERIA FOR OPHTHALMOLOGICAL DISEASES

The diagnoses and treatments were recorded based on the final evaluation of the patient. The diagnoses included refractive errors, conjunctivitis, strabismus, amblyopia, glaucoma, trauma, nasolacrimal duct obstructions (NLDOs), retinal diseases, chalazion, ptoses, cataracts, corneal scars, and xerophthalmia. Conjunctivitis is the inflammation of the conjunctiva caused by a bacterial or viral infection or an allergy. Strabismus describes the deviation of one eye away from the fixation point. Amblyopia is poor vision resulting from the lack of development of the appropriate synapses and cells in the visual cortex due to inadequate stimulation during infancy and childhood. Glaucoma is a chronic, progressive, optic neuropathy caused by a group of ocular conditions that lead to damage of the optic nerve and a loss of visual function. In childhood, it can be seen as either congenital or juvenile.

NLDOs in children are congenital in most cases. Chalazion is a chronic granulomatous inflammation of the meibomian gland caused by in-

flammatory, vascular, congenital, and systemic diseases, trauma, and tumors. Ptosis is a condition in which there is a drooping of the upper lid below its normal position. A cataract is defined as any opacity in the lens or its capsule, and it can be either developmental or acquired. Corneal scarring refers to the loss of transparency of the cornea, which is the result of trauma, improper contact lens use, ulcers, infections, or diseases. Xerophthalmia describes a dry, lusterless condition of the conjunctiva due unstable tear film, which exposes the conjunctival and corneal epithelium to evaporation.

The refractive errors consisted of myopia, hypermetropia, and astigmatism. Myopia is a dioptric condition of the eye in which incident parallel rays of light come to a focus anterior to the light sensitive layer of the retina. Hypermetropia is another dioptric condition of the eye in which the incident parallel rays of light come to a focus posterior to the light sensitive layer of the retina. Astigmatism is a condition of refraction in which a point of light cannot be made to produce a punctate image upon the retina by any spherical corrective lens.

STATISTICAL ANALYSIS

The study data was summarized using descriptive statistics (e.g., frequencies and percentages). The statistical analysis was performed using IBM SPSS Statistics for Windows version 21.0 (IBM Corp., Armonk, NY, USA).

RESULTS

The female to male ratio in the study cohort of 500 children was 1:1. Of the children, 38.6% were 0-5 years old, 31.6% were 6-11 years old, and 29.8% were 12-18 years old (Table 1). Moreover, 483 (96.6%) were diagnosed with one or more eye diseases. Refractive errors were the most prevalent eye diseases recorded (n=434, 86.6%), followed by conjunctivitis (24.4%), strabismus (11.8%), amblyopia (9.2%), and glaucoma (8.0%) (Table 2, Figure 1). Of the 122 children with conjunctivitis, 80 (65.5%) had allergic conjunctivitis and 42 (34.5%) had infectious conjunctivitis. The least prevalent eye diseases were cataracts (n=6, 1.2%), ptoses (n=6, 1.2%), corneal scars (n=4, 0.8%), and xerophthalmia (n=2, 0.4%).

TABLE 1: Demographics of study cohort.

	n (%)
Gender	
Male	250 (50.0)
Female	250 (50.0)
Age	
Less than 1 year	38 (7.6)
1-5 years	155 (31.0)
6-11 years	158 (31.6)
12-18 years	149 (29.8)
Total	500 (100.0)

There were no significant differences between the male and female patients in terms of the prevalences of any of the eye diseases (Table 2). However, when the patients were evaluated according to their age groups, the children who were 6–11 years old had remarkably lower prevalences of refractive errors (70.3%), strabismus (7.6%), amblyopia (3.2%), and glaucoma (4.4%) than those who were 0-5 years old and 12-18 years old (Table 2). The most commonly seen refractive errors were hypermetropia in the children aged 0-5 years old and myopia in the children 6 years old and older (Table 3). The refractive errors were treated most often with eyeglasses. Low-dose atropine was used for the treatment of rapidly progressing myopia.

The treatments applied for these eye diseases were eyeglasses, medications, occlusion therapy, contact lenses, and strabismus surgery, in that order of frequency (Table 4). A total of 258 eyeglasses and 24 contact lenses were prescribed for 282 of the 434 patients with refractive errors. The others did not undergo treatment because their refractive errors were minor. Overall, 104 patients did not undergo treatment.

DISCUSSION

Visual development is the process of interpreting signals that originate in the eye, and it occurs in the brain between the ages of 0 and 8 years old. It is

TABLE 2: The prevalence of eye diseases in all 500 children and with respect to gender and age.

		Gender			Age			
	Total	Male	Female		0-5 years	6-11 years	12-18 years	
	(n=500)	(n=250)	(n=250)	p value*	(n=193)	(n=158)	(n=149)	p value*
Refractive error	434 (86.6%)	214 (85.6%)	220 (88.0%)	0.428	186 (96.4%)	111 (70.3%)	137 (91.9%)	<0.001
Conjunctivitis	122 (24.4%)	65 (26.0%)	57 (22.8%)	0.405	47 (24.4%)	36 (22.8%)	39 (26.2%)	0.788
Strabismus	59 (11.8%)	34 (13.6%)	25 (10.0%)	0.212	29 (15.0%)	12 (7.6%)	18 (12.1%)	0.99
Amblyopia	46 (9.2%)	25 (10.0%)	21 (8.4%)	0.536	28 (14.5%)	5 (3.2%)	13 (8.7%)	0.001
Glaucoma	40 (8.0%)	17 (6.8%)	23 (9.2%)	0.323	19 (9.8%)	7 (4.4%)	14 (9.4%)	0.059
Trauma	28 (5.6%)	13 (5.2%)	15 (6.0%)	0.697	4 (2.1%)	11 (7.0%)	13 (8.7%)	0.02
Nasolacrimal duct obstruction	18 (3.6%)	5 (2.0%)	13 (5.2%)	0.055	8 (4.1%)	3 (1.9%)	7 (4.7%)	0.368
Retinal disease	17 (3.4%)	5 (2.0%)	12 (4.8%)	0.084	6 (3.1%)	6 (3.8%)	5 (3.4%)	0.939
Chalazion	7 (1.4%)	3 (1.2%)	4 (1.6%)	0.703	5 (2.6%)	2 (1.3%)	0 (0.0%)	0.128
Ptosis	6 (1.2%)	2 (0.8%)	4 (1.6%)	0.411	3 (1.6%)	2 (1.3%)	1 (0.7%)	0.755
Cataract	6 (1.2%)	1 (0.4%)	5 (2.0%)	0.100	4 (2.1%)	1 (0.6%)	1 (0.7%)	0.364
Corneal scars	4 (0.8%)	3 (1.2%)	1 (0.4%)	-	3 (1.6%)	0 (0.0%)	1 (0.7%)	-
Xerophthalmia	2 (0.4%)	0 (0.0%)	2 (0.8%)	-	1 (0.5%)	0 (0.0%)	1 (0.7%)	-
None	17 (3.4%)	10 (4.0%)	7 (2.8%)	-	6 (3.1%)	8 (5.1%)	3 (2.0%)	-

Since some children had more than one eye disease, total of percentages was over 100%. *Pearson chi-square test.

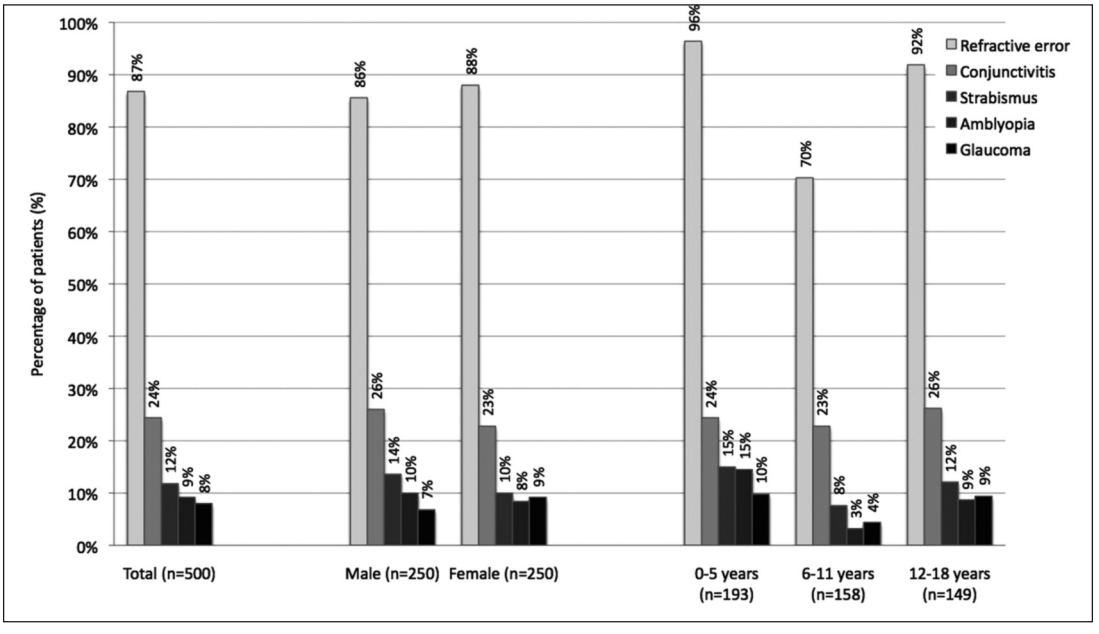

FIGURE 1: Distribution of five most prevalent eye diseases in all 500 children and with respect to age and gender.

extremely important for a child's brain to complete this process without any permanent problems. Diseases that affect the development of a child can also affect his/her daily life quality, education, social life, and eventually, their future. Almost 1.5 million children worldwide are suffering from blindness, and approximately half a million children experience blindness each year (i.e., one child goes blind every second).[3] Half of these children lose their lives during their first two years of blindness.[10] This data shows the importance of pediatric ophthalmology studies. In the present study, we evaluated the eye disease and treatment frequencies in a cohort of 500 children presenting to a sin-

TABLE 3: The prevalence of refractive errors with respect to age groups.

	Emmetropia n (%)	Myopia (+/- Astigmatism) n (%)	Hypermetropia (+/- Astigmatism) n (%)	Total
<1 Years	0 (0.0)	2 (5.3)	36 (94.7)	38
1-5 Years	20 (17.1)	10 (8.5)	87 (74.4)	117
6-11 Years	21 (18.9)	58 (52.3)	32 (28.8)	111
12-18 Years	25 (18.2)	85 (62.0)	27 (19.7)	137
Total	66 (16.4)	155 (38.5)	182 (45.2)	403

TABLE 4: Treatments applied for eye diseases detected in 500 children.

Treatment	n (%)
Eye glasses	258 (51.6)
Medication	179 (35.8)
Occlusion	35 (7.0)
Contact lens	24 (4.8)
Strabismus operation	10 (2.0)
Massage	9 (1.8)
Cataract operation	4 (0.8)
Probing	4 (0.8)
Retinal operation	2 (0.4)
Corneal cross-linking	1 (0.2)
Nasolacrimal duct obstruction massage	0 (0.0)
Botox	0 (0.0)
None	104 (20.8)

gle pediatric ophthalmology clinic in Istanbul, Turkey. In our cohort, there were 483 children (96.6%) who had at least one eye disease. Our largest group consisted of 193 children between 0 and 5 years old with 343 eye diseases. This large group could have been the result of the accessibility of medical care for newborns who have doctor's appointments regularly.

The most common disease in our study was refractive errors, which were recorded in 434 patients (86.6%). Similar to previous studies, the most common refractive errors were hypermetropia in children aged 0-5 years old and myopia in children 6 years old and older.[11] Moreover, refractive errors were the most common ophthalmological disorders seen during childhood in studies from Saudi Arabia, Northern India, and Ethiopia.[12-14] In one study in North America, nearly 9% of 2,523 children between 5 and 17 years old was diagnosed with at least -0.75 D of myopia. In the same study, at least +1.25 D of hypermetropia was found in 13% of the children.[15] Genetics and increasing rates of "near work" (close up) along with limited outdoor activities in children may result in refractive errors. The WHO Vision 2020 states that uncorrected refractive errors in children are a major area in which immediate action needs to be taken.[2] Refractive errors are a preventable cause of visual disability and blindness in children. Uncorrected refractive errors can result in amblyopia or strabismus, and they can have immediate and long-term consequences in children, such as poor school performance and an impaired quality of life.[11] The risk of developing amblyopia increases if children are not screened early for refractive errors, and they are not corrected on time. Most of the children with uncorrected refractive errors were asymptomatic; therefore, screening helps to provide early detection and timely interventions in order to avoid complications.[11] Early screening is an important precaution against high refractive error rates.

Pediatric conjunctivitis is a common childhood condition with a benign etiology and a self-limiting course. Conjunctivitis can be caused by infectious (bacterial and viral) and noninfectious (allergies and chemicals) factors, each of which comes with its own set of signs and treatment options.[16] Conjunctivitis (n=122, 24.4%) was the second most common disorder in the present study. Eighty (65.6%) of the children with conjunctivitis had allergic conjunctivitis, which is the most common disease worldwide.[17] In another study, approximately 30% of the study population had allergies, and 40-80% of these children had allergic conjunctivitis.[18] In cases with a burning sensation and itchy eyes, unhygienic living conditions, improper contact lens usage, and crowded schools should be considered. The diagnosis should be based on the clinical symptoms and findings, and the treatment should be applied according to the conjunctivitis cause.

In our study, the third most commonly seen disorder was strabismus (n=59, 11.8%). Strabismus (i.e., ocular misalignment) can be horizontal or vertical, comitant (same deviation angle in all of the gaze positions) or incomitant (deviation angle varies in the different gaze positions), latent, manifest, or intermittent. Muscle dysfunction, hypermetropia, amblyopia, and neurological problems can all cause strabismus. Ten strabismus surgeries were performed in 59 of the children in this study. Nineteen of the children were treated with occlusion therapy, and 6 of these children also had amblyopia. Atropine penalization treatments for amblyopia were administered to 12 children. Forty-nine children with refractive errors accompanied by strabismus were prescribed glasses. If strabismus is not treated properly, it can lead to amblyopia, which is a leading cause of visual impairment in children (affecting approximately 2-3%), and it usually begins in infancy or childhood.[19] Congenital cataracts, congenital ptoses, corneal injuries, and corneal dystrophy can also cause amblyopia, but these are less common. In most cases, amblyopia is unilateral; therefore, even severe cases may not be detected by the parents.

Globally, different population based studies have suggested that screening increases the likelihood of amblyopia detection and successful treatment. With appropriate interventions, most of the vision loss from amblyopia is preventable or reversible. Amblyopic children respond better to treatment during their early visual development, before the reach 7 or 8 years of age.[19] Therefore, early diagnosis and treatment are critically important in children with amblyopia. In our cohort, amblyopia was recorded in 46 of the patients (5.7%). It is a treatable condition, especially during childhood, so early detection is extremely important. Detecting amblyogenic factors before a child turns 2 years old is the best way to manage amblyopia.[20] In our study, we administered occlusion therapy in 76% of the amblyopic patients (35 of 46 children). Using this therapy, the amblyopic eye is forced to function when the other eye is covered with a patch.

In this study, 40 children (8.0%) suffered from glaucoma, and nearly half of them were under 6 years old. The rate of childhood glaucoma is approximately 2.29 per 100,000 patients younger than 20 years old in the United States.[21] These children commonly develop myopia, amblyopia, and strabismus. Even after aggressive treatment, glaucoma can still cause permanent vision loss. Worldwide, approximately 2% of all visual impairments are caused by glaucoma.[3] However, early diagnosis and treatment can reduce the effects of glaucoma on the rest of a child's life.

Congenital cataracts present in approximately 0.4% of newborn babies, and most require surgery, which is recommended within the first two months of life.[22,23] In our study, 6 children (1.2%), 4 of which were under 6 years old, were diagnosed with cataracts, and 4 cataract operations were performed.

In our study cohort, there were no gender differences in the prevalences of any of the eye diseases. As expected, the children that were 6-11 years old had remarkably lower prevalences of refractive errors, strabismus, amblyopia, and glaucoma than the children that were 0-5 years old and 12-18 years old.

STUDY LIMITATIONS

The main limitation of our study was its hospital-based, single-centered design, which restricts its representation of ophthalmology clinics that serve patient groups with different socioeconomic backgrounds. Moreover, because our study cohort represented children who were admitted to a pediatric ophthalmology clinic with an eye complaint, our findings cannot be extrapolated to the healthy children in the population. Nevertheless, our findings will guide pediatric ophthalmologists with regard to the frequency and treatment of childhood eye diseases in daily clinical practice, and they form a basis for future studies of the childhood eye disease prevalences in Turkey.

CONCLUSION

Based on the results of this study, refractive errors, conjunctivitis, strabismus, and amblyopia were the most common diseases encountered in daily prac-

tice in a pediatric ophthalmology clinic. Increasing the public's awareness and knowledge is crucial for better and earlier management of childhood eye diseases.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Özgün Melike Gedar Totuk, Kerem Kabadayı, Naz Ekizoğlu;* ***Design:*** *Özgün Melike Gedar Totuk, Kerem Kabadayı, Naz Ekizoğlu, Tülay Arıcı;* ***Control/Supervision:*** *Özgün Melike Gedar Totuk, Tülay Arıcı;* ***Data Collection and/or Processing:*** *Kerem Kabadayı, Naz Ekizoğlu;* ***Analysis and/or Interpretation:*** *Özgün Melike Gedar Totuk, Kerem Kabadayı, Naz Ekizoğlu, Tülay Arıcı;* ***Literature Review:*** *Kerem Kabadayı, Naz Ekizoğlu;* ***Writing the Article:*** *Özgün Melike Gedar Totuk, Kerem Kabadayı, Naz Ekizoğlu, Tülay Arıcı;* ***Critical Review:*** *Özgün Melike Gedar Totuk, Tülay Arıcı;* ***References and Fundings:*** *Özgün Melike Gedar Totuk, Tülay Arıcı;* ***Materials:*** *Özgün Melike Gedar Totuk, Tülay Arıcı.*

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