

ChatGPT, Google Assistant: Which is best for patients with amblyopia?

Gloria Wu, David Lee, Weichen Zhao, Adrial Wong, Rohan Jhangiani, Sri Kurniawan

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Gloria Wu¹ MD; David Lee² MD, MBA; Weichen Zhao³ BS; Adrial Wong³ BS; Rohan Jhangiani⁴ MS, BS; Sri Kurniawan⁵ PhD

¹University of California, San Francisco School of Medicine San Francisco US

²University of Texas Health Science Center at Houston McGovern Medical School Houston US

³University of California, Davis Davis US

⁴University of California, Santa Cruz Santa Cruz US

⁵University of California Santa Cruz US

Corresponding Author:

Gloria Wu MD

University of California, San Francisco School of Medicine

533 Parnassus Ave

San Francisco

US

Abstract

Background: We queried ChatGPT and Google Assistant about amblyopia and compared its answers to the keywords found in the website of American Association for Pediatric Ophthalmology and Strabismus, section for amblyopia. Of the 26 keywords chosen from website: ChatGPT included 11/26 in its responses while Google included 8/26.

Objective: Our study investigates ChatGPT-3.5TM and Google assistantTM's adherence to the American Association for Pediatric Ophthalmology and Strabismus' (AAPOS) guidelines for patient education of amblyopia.

Methods: ChatGPT-3.5 was used, available from November 30, 2022. The 4 questions were taken from American Association for Pediatric Ophthalmology and Strabismus's website (AAPOS.org), specifically its glossary section for amblyopia: 1) What is amblyopia? 2) What causes amblyopia? 3) How is amblyopia treated? 4) What happens if amblyopia is untreated? Approved and selected by Dr. Gloria Wu and Dr. David Lee, the keywords from AAPOS.org were words or phrases that are deemed significant to the education of patients with amblyopia. The "Flesch-Kincaid Grade Level" formula, approved by the US Department of Education, was used to evaluate the reading comprehension level for the ChatGPT, Google Assistant, and AAPOS responses.

Results: In their responses, ChatGPT did not mention the term "ophthalmologist" whereas Google Assistant and AAPOS.org both mentioned the term once, and twice respectively. ChatGPT did, however, use the term "eye doctors" once. From the Flesch-Kincaid test, AAPOS.org reading level was 11.4 ± 2.1 , the lowest level. Google displayed 13.1 ± 4.8 , the highest required reading level while also having the greatest variation in grade level in its responses. ChatGPT answers scored 12.4 ± 1.1 . They were all similar in terms of level of difficulty in reading. For the key words, of the 4 responses, ChatGPT used the keywords 11/26 times, and Google Assistant 8/26 times.

Conclusions: ChatGPT trains on texts and phrases and generates new sentences vs. Google Assistant automatically copies website links. As ophthalmologists, through our websites and journals, we should consider encoding "see an ophthalmologist" in our websites. While ChatGPT is here to stay, we, as physicians, need to monitor its answers.

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Gloria Wu, MD

University of California, San Francisco
School of Medicine
Department of Ophthalmology
San Francisco, California, United States
No Financial Disclosure

For correspondence and reprints:

2550 Samaritan Dr, Suite C
San Jose, California, United States
Fax: +1(408)-356-5556
Telephone: +1(408)-621-9074
Email: gwu2550@gmail.com

David A. Lee, MD, MS, MBA

University of Texas Health Science Center at Houston
McGovern Medical School
Houston, Texas, United States
No Financial Disclosure

Weichen Zhao, BS

University of California, Davis
Davis, California, United States
No Financial Disclosure

Adrial Wong, BS

University of California, Davis
Davis, California, United States
No Financial Disclosure

Rohan Jhangiani, BS, MS

Department of Computational Media
University of California, Santa Cruz
Santa Cruz, CA, United States
No Financial Disclosure

Sri Kurniawan, PhD

Department of Computational Media
University of California, Santa Cruz
Santa Cruz, CA, United States
No Financial Disclosure

Precis

We queried ChatGPT and Google Assistant about amblyopia and compared their answers to the keywords found on the American Association for Pediatric Ophthalmology and Strabismus website, specifically the section on amblyopia. Out of the 26 keywords chosen from the website, ChatGPT included 11/26 (42.3%) in its responses, while Google included 8/26 (30.8%).

Abstract

Purpose: Our study investigates the adherence of ChatGPT-3.5TM and Google Assistant to the guidelines of the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) for patient education on amblyopia.

Methods: ChatGPT-3.5 was used. The 4 questions were taken from the American Association for

Pediatric Ophthalmology and Strabismus website (AAPOS.org), specifically its glossary section for amblyopia: 1) What is amblyopia? 2) What causes amblyopia? 3) How is amblyopia treated? 4) What happens if amblyopia is untreated? Approved and selected by ophthalmologists, Drs. Gloria Wu and David Lee, the keywords from AAPOS were words or phrases deemed significant for the education of patients with amblyopia. The "Flesch-Kincaid Grade Level" formula, approved by the US Department of Education, was used to evaluate the reading comprehension level for the responses from ChatGPT, Google Assistant, and AAPOS.

Results: In their responses, ChatGPT did not mention the term "ophthalmologist," whereas Google Assistant and AAPOS both mentioned the term once and twice, respectively. ChatGPT did, however, use the term "eye doctors" once. According to the Flesch-Kincaid test, the reading level of AAPOS was 11.4 ± 2.1 , the lowest level, while Google displayed 13.1 ± 4.8 , the highest required reading level, also showing the greatest variation in grade level in its responses. ChatGPT's answers scored 12.4 ± 1.1 grade level. They were all similar in terms of difficulty level in reading. For the keywords, out of the 4 responses, ChatGPT used the keywords 42.3% (11/26) versus that of Google Assistant 30.8% (8/26).

Conclusion: ChatGPT trains on texts and phrases and generates new sentences, while Google Assistant automatically copies website links. As ophthalmologists, we should consider including "see an ophthalmologist" on our websites and journals. While ChatGPT is here to stay, we, as physicians, need to monitor its answers.

Keywords

ChatGPT, Google Assistant, amblyopia, health literacy, American Association of Pediatric Ophthalmology and Strabismus

Introduction

Amblyopia is a global public health problem with multiple impacts on vision and quality of life [1]. Amblyopia, if untreated, leads to permanent visual impairment in adults. The underlying causes are undiscovered anisometropia (unequal refractive error between the two eyes), visual deprivation such as congenital or juvenile cataracts, or strabismus with anisometropia. Treatment can be as simple as a pair of glasses. Treatment may mean occlusion therapy of the stronger eye, ensuring that the “weaker” or amblyopic eye gets visual stimulation. If treated early, the young child will have improved binocular vision.

Amblyopia is a common visual complaint in children in an ophthalmology setting. Vision at the level of 20/80 to 20/200 makes up almost 40% of the cases in a population-based study in Australia [2]. The critical period of human visual development is in the first decade of life [3]. Recent neuroplasticity models in humans and primates suggest that there is residual plasticity that extends into later years of adult life [3].

The quality of life for people with amblyopia can involve difficulties in daily activities due to impaired reading speed, stereo acuity, motor skills, motion perception, and fixation stability [4,5].

Health education is needed in the field of amblyopia. Only if there is public awareness can patients seek help in a timely manner. Often, the patient is young and not able to articulate his visual complaints. The parents may also be young and not aware of vision research and brain plasticity.

ChatGPT-3.5 is a free, advanced large language model (LLM) (OpenAI, San Francisco) launched on November 30, 2022. By December 4, 2022, it had over 1 million users, and by the two-month mark, the monthly active users had been reported to exceed 100 million [6]. The demographics of ChatGPT users are those of the internet user population. Ages 18-29 are the average age, matching the ages of young parents with amblyopic children. [7] ChatGPT-3.5 has natural language processing capabilities and uses artificial intelligence (AI) to train in the auto-completion of sentences and ideas.

Health literacy may be a problem for ChatGPT-3.5 and patient users [8,9,10]. ChatGPT-3.5 could aid in patient education, but it types out texts in advanced high school to college-level English. One hundred thirty million Americans lack proficiency in literacy, essentially reading below the equivalent of a sixth-grade level [9]. The average American reads between 7th and 8th grade [10,11]. Health literacy is a recognized problem for most Americans [11,12,13].

Can ChatGPT and Google Assistant be a source of patient education for our patients with amblyopia? Is it accurate, is it understandable [14,15]? Our study investigates whether an LLM and a virtual assistant can adhere to the AAPOS guidelines for patient education. The American Association of Pediatric Ophthalmology and Strabismus is an authoritative organization that provides educational information to the public and ophthalmologists about various eye diseases in children [16]. On the AAPOS website, there is patient information for many eye diseases including amblyopia [16]. No Institutional Review Board approval was required because no patient subjects or patient data were involved in this study.

Methods

In AAPOS's "Learn More About Eye Conditions" section, there is a glossary of terms for "Amblyopia" [16]. From that hyperlink, we found the AAPOS' four questions to query ChatGPT-3.5

and Google Assistant and then subsequently recorded their responses. The embedded video was transcribed using the “closed caption” option. Henceforth, AAPOS will refer to this section of the website for the purpose of this paper. From AAPOS, two ophthalmologists (GW, and DAL) chose the keywords within the text. The text was transcribed in Google Docs and was included in the keywords.

We chose the ChatGPT-3.5 version because it is the free and most widely used version. The more advanced Chat-GPT-4.0, released on March 13, 2023, requires a paid subscription.

The four questions from the AAPOS website “amblyopia” are: 1) What is amblyopia? 2) What causes amblyopia? 3) How is amblyopia treated? 4) What happens if amblyopia is not treated? [16].

To assess the chatbots' responses, we used the Flesch-Kincaid grade level test. This test has been used by the US Navy since the 1970s [17]. In addition, Flesch-Kincaid has been used to score [18,19]. It has also been used in the Pennsylvania Department of Insurance to ensure readability [20].

For scoring the reading level, we used the "Flesch–Kincaid grade level Formula", which presents a score as a U.S. grade level [17]. This test is used in the US Navy and the US Department of Education to allow teachers, parents, librarians, and others to judge the readability level of school books and textbooks [17]. The formula yields the “mean number of years of education” generally required to understand the book, text, or assigned reading. The resultant score (grade level) is particularly relevant when the number is greater than the 10th grade. The formula for Flesch-Kincaid is [21]:

$$\text{Grade Level} = 0.39 * (\text{words/sentences}) + 11.8 * (\text{syllables/words}) - 15.59$$

The AAPOS, ChatGPT-3.5, and Google Assistant responses to the questions were pasted into the Flesch-Kincaid Readability Calculator to obtain the readability grade levels [22]. For the word

count measurement, we employed Google Documents tools. Keywords from the AAPOS website were used as a reference point to score the ChatGPT-3.5 and Google Assistant responses. A total of 26 terms were used in the 4 questions from the AAPOS website.

Results

For the 4 responses, ChatGPT used “eye doctor” once and never used “ophthalmologist”. Meanwhile, Google Assistant used “ophthalmologist” once, and AAPOS used the term twice, while neither used “eye doctor.” Giving weighted scores to the individual keywords for the 4 questions, ChatGPT scored 47% in keyword usage, while Google scored 46%.

AAPOS displayed the lowest reading comprehension level necessary among the three sources (11.4 ± 2.1), whereas Google Assistant showed the highest level (13.1 ± 4.8). ChatGPT displayed an average reading grade level of 12.4 ± 1.1 . In performing Statistical T-tests between the Flesch-Kincaid grades of the questions, we see that none of the responses varied in reading level significantly from one another. However, the word counts of the responses were significantly different between AAPOS and Google Assistant, as well as between ChatGPT and Google Assistant: $p = 0.57$;

AAPOS vs Google Assistant: $p = 0.000001$; ChatGPT vs Google Assistant: $p = 0.0001$.

Table 1. Comparison of Keywords

Comparison of Keywords								Weighted Score			
Qn	AAP	CG	GA	AAP	CG Total	GA Total	AAP Total	Points	CG Points	GA Points	AAP Points
1	Lazy eye	✓	✓	✓	3/7	2/7	7/7	4	12/25	8/25	25/25
	Brain	✓	✓	✓				4			
	High refractive error			✓				3			
	Strong glasses			✓				3			
	Early childhood/young age			✓				3			
	Vision loss	✓		✓				4			
	Abnormal vision development			✓				4			
2	Eye Crosses			✓	4/11	0/11	11/11	3	8/25	0/25	25/25
	Eye Drifts out			✓				3			
	Brain avoids double vision			✓				2			
	Suppressing the vision			✓				3			
	Cataract	✓		✓				2			
	Drooping eyelid			✓				2			
	No clues			✓				2			
	Pediatrician			✓				2			
	Deprivation	✓		✓				2			
	Strabismus	✓		✓				2			
	Refractive	✓		✓				2			
3	Glasses/contact lenses	✓	✓	✓	3/4	4/4	4/4	7	19/25	25/25	25/25
	Patches/patching	✓	✓	✓				7			
	Surgery		✓	✓				6			
	Drops	✓	✓	✓				5			
4	9-10 yrs (cut off for effective treatment)			✓	1/4	2/4	4/4	7	8/25	13/25	25/25
	Pediatric ophthalmologist			✓				5			
	Permanent vision decrease/loss	✓	✓	✓				8			
	Ophthalmologist		✓	✓				5			
Total Keyword Appearance					11/26	8/26	26/26	Percentage of points earned	47/100	46/100	100/100

Table 2. Flesch-Kincaid Grade Level

Question #	Flesch-Kincaid Grade Level		
	ChatGPT	AAPOS	Google

1	11	9.5	10.7
2	12.6	10.4	7
3	12.5	14.3	15.7
4	13.6	11.4	13.3
Average	12.4	11.4	13.1
Standard Dev	1.1	2.1	4.8

T-test p-values:

AAPOS vs ChatGPT: $p = 0.415$;

AAPOS vs Google Assistant: $p = 0.902$;

ChatGPT vs Google Assistant: $p = 0.712$.

Table 3. Word count

Question #	Word Count		
	ChatGPT	AAPOS	Google
1	167	110	44
2	188	172	56
3	228	77	38
4	164	63	46
Average	186.8	105.5	46.0
Standard Dev	29.5	48.5	7.5

T-test p-values:

AAPOS vs ChatGPT: $p = 0.57$;

AAPOS vs Google Assistant: $p = 0.000001$;

ChatGPT vs Google Assistant: $p = 0.0001$.

For question 4, ChatGPT's answer is misleading: it cites age 6 as the preferable age to start treating amblyopia. Effective intervention in amblyopia can start as early as possible, and even as late as age 9 or 10, according to AAPOS. Recovery of vision at any age is considered an improvement versus no treatment. The subtleties are missing in the ChatGPT answers. In addition, there are errors in omission when not mentioning the need to see an ophthalmologist or pediatric ophthalmologist or pediatrician.

Discussion

During the past two years of the COVID-19 pandemic, many patients self-isolated or were afraid to go to their doctor's appointments for eye care. Many of their family members use the internet or virtual assistants for patient information. The natural language model in ChatGPT met an

unspoken need [23,24,25,26]. By 2023, there were 100 million ChatGPT users from all over the world accessed this natural language model. Google Assistant was first launched in May 2016 and has the largest share of the virtual assistant market. Google Assistant uses Google's AI but relies on search engine optimization since it lists snippets of phrases from websites in its citations [27]. While the answers are short for Google Assistant, they are succinct and to the point. They are a shorthand complement to ChatGPT's long-winded answers.

ChatGPT may play a role in patient education but when compared to AAPOS, the LLM mentions "eye doctor" once, not ophthalmologist" versus Google Assistant which does mention "ophthalmologist." Both ChatGPT and Google Assistant mention "lazy eye" and "brain" which is excellent. The 3.5 version of ChatGPT was trained on the Internet through the year 2021 as of this writing but by the time of publication, ChatGPT 3.5 may be trained on additional years of Internet data.

We are unclear about the training datasets for these LLMs. Ophthalmic patients number 6 million in America, whereas hypertension patients number 90 million; thus, ChatGPT's ability to recognize ophthalmic terminology may be more limited. More patients are asking questions about common American afflictions such as heart disease, stroke, and diabetes than eye diseases.

One of the disadvantages of AAPOS, Google Assistant, and ChatGPT's text responses is that all of these modalities require a high reading level, greater than the 7th to 8th-grade reading level of the average American [9]. Our more educated amblyopia patients will be able to understand that partial loss of vision is intertwined with brain development. The ability to process these ideas may require higher health literacy and higher education levels than most young parents.

Our patients from diverse backgrounds in the US may not be able to understand ChatGPT, AAPOS, and Google Assistant. The American Academy of Ophthalmology website section, "Public & Patients," has material written at the 7th or 8th-grade level and the answers are less detailed than the AAPOS.org [16].

Another potential problem that might arise with the use of LLMs is that natural language is set in a conversational tone, thus minor flaws such as “go see a doctor” may seem perfectly normal. ChatGPT and Google Assistant have information about amblyopia for the lay public. None of the answers tell patients about the urgency or need to see a pediatric ophthalmologist. This is due to the responses created by the prompt engineers who manage the chatbots’ answers. In 2024, all ChatGPT responses have attached statements, “please see a medical professional.”

In the spring of 2023, there were new competitors to ChatGPT. BARD and PALM2 are both Google-directed AI large language models [27,28,29]. BARD was launched briefly in March 2023 and May 2023 with mixed results in Europe. However, in mid-August 2023, it was launched in the US. Its algorithms are augmented with those created under PaLM2 [28,29]. As of this writing, BARD was replaced by Gemini on February 8, 2024.

PaLM2, which powers Gemini, has 160 languages and the future capability of “deductive reasoning” [28,29]. Gemini is part of the powerful Google search engine, which can access the user’s past history of queries. Thus, Gemini can provide a tailored response for the user. Whether or not this will make Gemini as popular as ChatGPT is unknown since it is the latest LLM for Google.

Open AI has ChatGPT and Microsoft has Copilot. Microsoft owns a large stake in OpenAI, the company that first launched ChatGPT. All the chatbots are free and easy to use, which will make them a source of health information.

Our patients have access to mobile apps and the internet, ChatGPT, Google Assist, Gemini, and more AI chatbots. They can compare different answers, which may be the solution for free patient education.

The use of these free chatbots can save the Pediatric Eye Clinic time and money as resources become scarce with increasing patient load and electronic chart documentation demands. A medical assistant is paid \$38,000 per year in the continental US [30]. An orthoptist has an average annual salary of \$90,000 [30]. The cost of ChatGPT 3.5 is zero. One can imagine the cost savings of one less medical assistant with full-time benefits versus a free Chatbot. At most, the paid

version of ChatGPT 4.0 is \$20 per month. The cost savings are an incentive for all Pediatric Eye and General Ophthalmology offices to be aware of this free resource. The ease of use will allow Open AI, the creator of ChatGPT, to gain market share and crush its competitors.

As physicians, we can assign medical assistants to show ChatGPT to selected patients with “lazy eyes.” In some cases, patients want reassurance and repeated explanations of “what is amblyopia.” Then, these chatbots and virtual assistants are a cost-effective means of public education. They are useful to our patients with poor access to physicians.

In conclusion, the age of AI-mediated technology for patient education has arrived. The latest LLM is available and provides cheap, free patient education in office settings [24,29,30]. The LLMs may communicate possible minor inaccuracies and biases to the LLMs and Google Assistant will improve their “training.” Already, ChatGPT is partnering with the Mayo Clinic and Stanford for conversational response emails to patients. There is now ambient Natural Language Processing which will allow us to “talk” to our patients and our notes will be immediately transcribed into our EHR.

In 2024, the LLM chatbots will provide users with clear warning messages when asking about medical conditions. Other chatbots will provide web resources from clinicians that meet current medical guidelines. This is especially important since these models do not have access to the patient's medical history and cannot fully understand the complexity of a patient's health situation [31].

As ophthalmologists, through our websites, and our journals, we have the power of our texts in the “training” of ChatGPT and future LLMs. In fact, in the user’s account, repeated questioning will “train” ChatGPT in 2024. This is new as of 2024. Individually as physicians, we can retype “see an ophthalmologist/pediatric ophthalmologist” as a necessary sentence fragment for our ophthalmic websites and web journals. From May 2023 to now, the current questions and answers have evolved in ChatGPT and the other chatbots to include phrasing that they are not physicians. There is evidence that the training is changing and by the time this article is published, the AI-mediated chatbot

answers will have improved with its million queries per day.

Patients and physicians may need Google Assistant, ChatGPT, and similar AI chatbots. We hope to harness the abundance of accessible information provided by LLMs to guide our patients' journey toward improved vision.

Table 4. ChatGPT Responses to Questions

1. What is amblyopia?
<p>Amblyopia, also known as lazy eye, is a condition that occurs when one eye does not develop normal vision during childhood. This happens because the brain receives different visual signals from the two eyes and learns to rely on the stronger eye. As a result, the weaker eye is not used properly and its vision does not develop properly.</p> <p>Amblyopia is a common condition, affecting about 2-3% of children. It usually develops before the age of 6 and can be caused by a variety of factors, including strabismus (misalignment of the eyes), unequal refractive errors (one eye has a different prescription than the other), or visual deprivation (e.g. cataract).</p> <p>If left untreated, amblyopia can cause permanent vision loss in the affected eye. However, early detection and treatment can often restore normal vision. Treatment usually involves correcting any underlying refractive errors, using an eye patch to encourage use of the weaker eye, or in some cases, using eye drops to blur the vision in the stronger eye.</p>
2. What causes Amblyopia?
<p>Amblyopia, also known as lazy eye, can be caused by several factors that affect the development of normal vision in childhood. The most common causes of amblyopia are:</p>

1. Strabismus: When the eyes are not properly aligned and point in different directions, it can cause the brain to receive different visual information from each eye. The brain then learns to ignore or suppress the information from one eye, leading to amblyopia.
2. Refractive errors: When one eye has a different prescription than the other eye, such as nearsightedness, farsightedness, or astigmatism, it can cause the brain to receive different visual information from each eye. If not corrected, this can lead to amblyopia in the weaker eye.
3. Visual deprivation: When something blocks or obstructs the vision in one eye, such as a cataract or ptosis (droopy eyelid), it can cause the brain to receive less visual information from that eye, leading to amblyopia.

It is important to detect and treat amblyopia as early as possible, ideally before the age of 6, when the visual system is still developing. If left untreated, amblyopia can cause permanent vision loss in the affected eye.

3. How is amblyopia treated?

The treatment for amblyopia, or lazy eye, depends on the underlying cause of the condition. In general, the goal of treatment is to strengthen the weaker eye and encourage the brain to use both eyes together. The earlier the treatment is started, the better the chance of restoring normal vision.

The most common treatments for amblyopia are:

1. Corrective lenses: If the amblyopia is caused by a refractive error, such as nearsightedness, farsightedness, or astigmatism, correcting the vision with glasses or contact lenses may be all that is needed to treat the condition.
2. Patching therapy: Covering the stronger eye with an eye patch for several hours a day can help encourage the weaker eye to work harder and develop better vision. The length and frequency of patching depends on the severity of the amblyopia and is determined by an eye doctor.
3. Atropine eye drops: In some cases, using atropine eye drops in the stronger eye can temporarily blur the vision and encourage the weaker eye to work harder.
4. Vision therapy: This involves a series of exercises and activities designed to improve visual acuity, depth perception, and eye coordination.

In more severe cases of amblyopia, a combination of these treatments may be needed. It is important to have regular follow-up visits with an eye doctor to monitor the progress of treatment and ensure that the condition is being properly managed.

4. What happens if amblyopia is not treated?

If amblyopia, or lazy eye, is left untreated, the weaker eye can continue to develop poor vision, leading to permanent vision loss. This occurs because the brain learns to rely on the stronger eye and suppresses or ignores the visual information from the weaker eye. Over time, the connections between the brain and the weaker eye can become weaker, making it more difficult to restore normal vision.

Amblyopia can also affect depth perception, eye-hand coordination, and visual processing skills. Children with amblyopia may have difficulty with tasks that require good vision in both eyes, such as reading, sports, or driving. In addition, amblyopia can affect self-esteem and social interactions, especially if the condition is noticeable or affects appearance.

It is important to detect and treat amblyopia as early as possible, ideally before the age of 6, when the visual system is still developing. If amblyopia is detected and treated early, there is a good chance of restoring normal vision and preventing permanent vision loss.

Table 5. Google Assistant Responses to Questions

1. What is amblyopia?
Amblyopia, also called lazy eye, is a disorder of sight in which the brain fails to fully process input from one eye and over time favors the other eye. It results in decreased vision in an eye that typically appears normal in other aspects.
2. What causes amblyopia?
It develops when there's a breakdown in how the brain and the eye work together, and the brain can't recognize the sight from 1 eye. Over time, the brain relies more and more on the other, stronger eye — while vision in the weaker eye gets worse. It's called "lazy eye" because the stronger eye works better.
3. How is amblyopia treated?
<p>Treatment consists of devices: Treatment includes eye patches, drops, glasses or contact lenses, and sometimes surgery.</p> <p>Devices: Bifocals, Corrective lens, Contact lenses, and Occlusion therapy</p> <p>Medications: Involuntary nervous system blocker</p> <p>Surgery: Eye surgery</p> <p>Specialists: Optometrist, Pediatrician, and Ophthalmologist.</p>
4. What happens if Amblyopia is not treated?
<p>If amblyopia is not treated early, specifically during the period of visual development between birth and 7 years of age, it can result in a permanent visual defect or loss of depth perception.</p> <p>If you suspect lazy eye in your child, consult a doctor right away.</p>

Table 6. AAPOS Responses to Questions

1. What is amblyopia?

[In this webcast we hope to provide you with a better understanding of what amblyopia is and how we treat it. amblyopia is often referred to as lazy eye by many people but a better term would be lazy vision. amblyopia is a medical term that either describes the loss of vision in because it is being ignored by the visual part of the brain or a decrease in vision in both eyes because of a very high refractive error which causes someone to need a strong glasses prescription. Amblyopia always begins in early childhood and is best treated effectively at a young age.]

Amblyopia is decreased vision in one or both eyes due to abnormal vision development in infancy or childhood. In the first few years of life, the brain must learn to see or interpret the images provided by the eyes. In amblyopia, the brain receives a poor image from the eye and thus does not “learn to see well. Vision loss occurs in this case because nerve pathways between the brain and the eye are not properly stimulated.

In amblyopia, there may not be an obvious problem of the eye. Another word for amblyopia is often “lazy eye.” It is the leading cause of vision loss amongst children.

2. What causes amblyopia?

[There are many causes of amblyopia sometimes there is an eye muscle control problem and one eye crosses in or drifts out in young children the brain avoids double vision by ignoring or suppressing the vision of one eye there can be structural problems with an eye including a cataract or drooping eyelid that actually blocks the vision from entering the eye properly. Oftentimes there are no clues that a child has amblyopia.]

Normal vision develops during the first few years of life. At birth, infants have very poor vision. As infants grow and use their eyes, the vision improves as the vision centers in the brain develop. If children are not able to use their eyes, the vision centers in the brain do not develop properly and the vision is decreased. Amblyopia may occur despite normal appearance of the eye structures.

The most common cause is refractive error in one or both eyes that is not corrected early in childhood resulting in poor development of the visual function in the affected eye(s). This is called refractive amblyopia. Another common cause is strabismus or eye misalignment. This is called strabismic amblyopia. Rarely there is a structural anomaly that impairs vision like a droopy eyelid or an opacity in the eye, such as a cataract or corneal scar. This is called deprivation amblyopia.

The three types of amblyopia, strabismic amblyopia, refractive amblyopia, and deprivation amblyopia, may occur at the same time in a single eye.

3. How is amblyopia treated?

[A common cause of amblyopia occurs when two eyes have different focus powers they cannot

work together and one eye is ignored unless a child wears glasses full time. Often children do not realize they cannot see as well out of one eye until a vision screening test at school or the pediatrician's office detects a problem when both eyes have amblyopia it is because both eyes have a very strong need for glasses the treatment for amblyopia first depends on the underlying cause treatment often requires glasses and some problems might require surgery.]

The treatment depends on the type of amblyopia present. Refractive and some forms of strabismic amblyopia are treated with glasses and/or contact lenses. Some forms of strabismic and deprivation amblyopia are treated with surgery (for example, by removing a cataract). If the amblyopia is only in one eye or much worse in one eye, amblyopia is treated by encouraging the child to use the weaker eye via patching or eye drops that blur the better-seeing eye.

4. What happens if Amblyopia is not treated?

[Most importantly treatment of the weaker eye requires patching or eye drops to blur the vision in the stronger eye this allows the vision and the weaker eye to catch up usually vision is most effectively improved up until the age of 9 to 10. If treatment is done as recommended, improvement after this age is still possible but it is less likely to normalize the vision because the brain doesn't respond as well to treatment. This is why it is so important to discover and treat amblyopia at a young age. For more information, you can look at www.aapos.org or ask your pediatric ophthalmologist]

If amblyopia is not treated in childhood, the vision in the affected eye(s) will be permanently decreased. Our current treatments for amblyopia are not effective in adults. For most children, the ophthalmologist will give the instructions and monitor the progress, but the patient and the family will do the hard work of actually performing amblyopia treatment by patching, glasses or eye drops.

*Brackets [] indicate the transcription of the captions from the informational video provided on the AAPOS.org amblyopia page.

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