



Major ophthalmological outcomes of the e-learning process in children and guidelines at COVID-19: a concise systematic review

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Abstract

Introduction: The effects on human health caused by the severe acute respiratory syndrome of coronavirus 2 (SARS-CoV-2) lead to several problems in the health, highlighted for ophthalmological diseases. The COVID-19 pandemic caused changes in eye care. In this sense, guidelines on safe ophthalmic practice have been developed worldwide. **Objective:** To present the main guidelines and considerations about the relationship between COVID-19 and eye care, especially to children and strabismus due to prolonged use of electronic devices. **Methods:** The research was carried out from June 2021 to August 2021 and developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, following the Systematic Review-PRISMA rules. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results:** After the selectivity of articles and literary findings through the following descriptors COVID-19, SARS-CoV-2, a total of 58 studies were analyzed, with only 20 medium and high-quality studies selected, according to the rules of the GRADE, and with bias risks that do not compromise scientific development, based on the Cochrane instrument. Early diagnosis and intervention are imperative. A specific set of guidelines for evaluating and managing cases of COVID-19 in children has been established to examine cases of pediatric ophthalmology and strabismus. These measures are necessary, given that the pandemic may still have a long duration. In this regard, although several forms of strabismus can be treated conservatively, without the need for surgery, most require surgical intervention. Strabismus can be treated conservatively for a short period with orthoptic

exercises, occlusion therapy, and prism glasses. The teleconsultation platform can provide primary eye care. Prolonging the use of smartphones for e-learning can lead to acute acquired comitotopia in children.

Conclusion: According to global guidelines, it is imperative to establish more specifically the care of children with strabismus in the COVID-19 pandemic. Examination of children must be performed according to the protocol recommended by the guidelines. Strabismus can be treated conservatively for a short period with orthoptic exercises, occlusion therapy, and prism glasses.

Keywords: COVID-19. SARS-CoV-2. Ophthalmological Diseases. Strabismus. Guidelines. E-learning.

Introduction

The effects on human health caused by the severe acute respiratory syndrome of coronavirus 2 (SARS-CoV-2) lead to several problems in the health, highlighted for ophthalmological diseases [1]. In this regard, COVID-19 is a highly contagious respiratory infection caused by SARS-CoV-2. The COVID-19 pandemic caused changes in eye care [2].

In this sense, guidelines on safe ophthalmic practice have been developed worldwide. However, there is still an information gap on the best care in the area of pediatric ophthalmology, strabismus, and neuro-ophthalmology, which involves dealing with children, surgery under general anesthesia, and managing possible life-threatening situations. Thus, the recommendations made by the expert group are specific [3]. In this context, COVID-19 resulted in major changes in the field of ophthalmology [4-10]. The rationale

behind the need for special adaptations stems from the fact that children are not only a vulnerable group to SARS-CoV-2 infection, but also pose a greater threat to transmitting the infection [11-13].

In fact, children often do not wear masks or wear ill-fitting masks that are ineffective in prevention [14]. Children are often afraid of masked doctors. Children are unlikely to follow social distance protocols. Children usually have parents or more than 1 companion accompanying them, increasing the chances of exposure. Children would generate more aerosol by crying, coughing, and resisting an eye exam. Children are more likely to be asymptomatic and may pass symptom-based screening [15,16]. Children are more likely to spread the virus for a longer period through nasal secretions and feces than asymptomatic children. Children require a longer examination time, including dilation, which increases the risk of exposure. Children are more likely to need sedation or general anesthesia for procedures and surgery [13].

Therefore, the present study prepared a concise systematic review in order to present the main guidelines and considerations about the relationship between COVID-19 and eye care, especially in relation to children and strabismus due to prolonged use of electronic devices.

Methods

Study Design

The rules of the Systematic Review-PRISMA Platform (Transparent reporting of systematic reviews and meta-analysis-[HTTP://www.prisma-statement.org/](http://www.prisma-statement.org/)) were followed [17].

Data sources and research strategy

The search strategies for this systematic review were based on the keywords (MeSH Terms): "COVID-19. SARS-CoV-2. Ophthalmological Diseases. Strabismus. Guidelines. E-learning". The research was carried out from June 2021 to July 2021 and developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar. Also, a combination of the keywords with the booleans "OR", "AND", and the operator "NOT" were used to target the scientific articles of interest.

Study Quality and Bias Risk

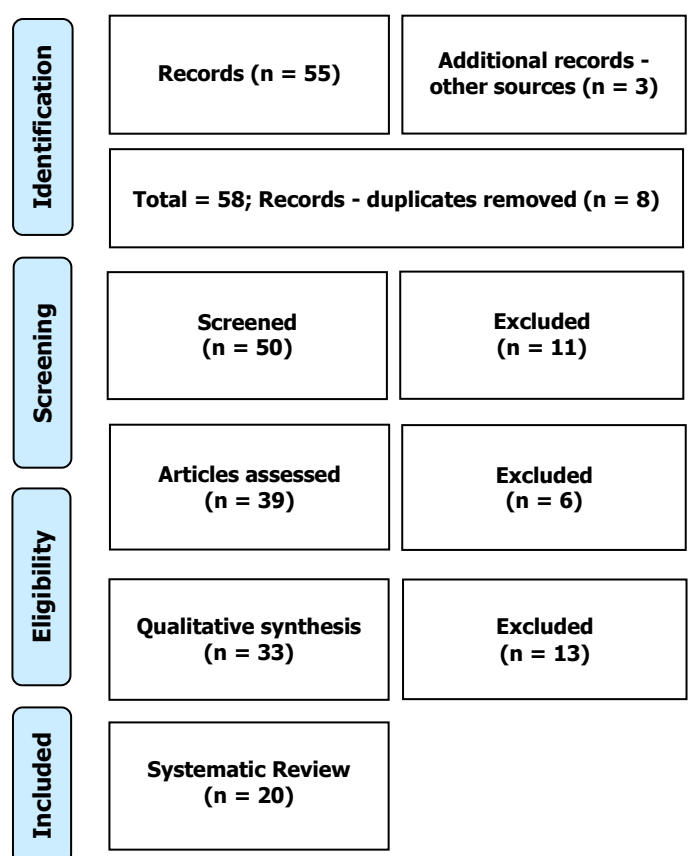
The quality of the studies was based on the GRADE instrument [18] and the risk of bias was analyzed according to the Cochrane instrument [19]. Two independent reviewers carried out research and study selection. Data extraction was performed by reviewer 1 and fully reviewed by reviewer 2. A third investigator

decided on some conflicting points and made the final decision to choose the articles.

Results

After the selectivity of articles and literary findings through the following descriptors COVID-19, SARS-CoV-2, Ophthalmological Diseases, Strabismus, Guidelines, and E-learning, a total of 58 studies were analyzed, with only 20 medium and high-quality studies selected, according to the rules of the GRADE, and with bias risks that do not compromise scientific development, based on the Cochrane instrument (**Figure 1**).

Figure 1. Scheme for selecting the studies.



It was found that early diagnosis and intervention are imperative. Additionally, SARSCoV2 is known to cause ocular and systemic conditions with neuro-ophthalmic manifestations. Thus, it was imperative to establish a specific set of guidelines to evaluate and manage cases of COVID-19 in children, to examine cases of pediatric ophthalmology and strabismus [10].

In this regard, the guidelines include the need to pre-register patients and see, based on consultations with only minimal visits, the need to screen patients and caregivers for symptoms or signs of infection, along with contact history, to examine a single patient, proper disinfection of rooms and instruments after each patient encounter and use of adequate personal protective

equipment [20]. Specific suggestions for the strabismus test include guidance on examining and evaluating a child in the clinic. These include instructions to parents or guardians to avoid bringing the child's family members, extending any scheduled routine tests for children with special needs, closing any children's play areas on the premises, avoiding distributing food to children, sanitizing children upon entry into facilities, and in the examination room, use masks for all children in an appropriate manner and children should always be held on laps or held by parents or guardians.

Also, for children under 2 years of age, a direct consultation can be performed without a formal optometry exam, avoid touching the head or face of children during visual acuity assessment, visual acuity assessment can be done through the occlusion of a child's eyes with disposable tissue or asking parents to close one eye at a time with their hands, strabismus can be assessed by the Hirschberg test instead of a prism bar coverage test or synoptophore use, for a child with a visual acuity of 6/6 (with or without glasses), there is no need to do dry refraction, there is no need for subjective acceptance if the decision is made based on cycloplegic refraction, if only the dilation is needed to view the background, 1 to 2 drops of tropicamide can be used, if cycloplegia is needed, parents can be instructed to put drops at home, manual self-refractors can be ideal for cycloplegia refraction. However, routine tonometry should be avoided, slit lamp and background examination should only be done when necessary, and examination under sedation may be preferable to examination under anesthesia [20].

These measures are necessary, given that the pandemic may still have a long duration. In this regard, although several forms of strabismus can be treated conservatively, without the need for surgery, most require surgical intervention. Even in cases that require surgery, strabismus can be treated conservatively for a short period with orthoptic exercises, occlusion therapy, and prism glasses [11,12,20].

Besides, a study analyzed 217 responses through an electronic questionnaire on the prevalence, frequency of symptoms, and risk factors associated with digital eye fatigue (DES) in children attending online classes during the COVID-19 pandemic. The children's mean age was 13 ± 2.45 years. The mean duration of the digital device used during the COVID era was 3.9 ± 1.9 h versus 1.9 ± 1.1 h in the Pre COVID-19 phase. Furthermore, a total of 36.9% ($n = 80$) used digital devices for more than 5 h in the COVID phase versus 1.8% ($n = 4$) in the Pre COVID-19 phase. The most commonly used digital device was smartphones ($n = 134$, 61.7%). The prevalence of DES was 50.23% (109/217). Of these, 26.3% were mild, 12.9%

moderate, and 11.1% severe. The most common symptoms were itching and headache ($n = 117$, 53.9%) [21].

Also, a study with 161 patients (mean age 7 years) performed a retrospective analysis of 30-day medical records on data from teleconsultations provided to pediatric ophthalmic patients and strabismus during COVID-19. There was an almost equal distribution by gender (53% men and 47% women). Video calling was used in 14%, review of shared clinical photos in 53%. The remainder of the 33% received telephone counseling. Allergic conjunctivitis (14%), pseudophakia (9%), strabismus (12%), post-surgery strabismus status (8%), cranial nerve palsy (11%) were common diagnoses. 19% ($n = 30$) received necessary guidance/consultation in emergency services on the same day or the next day. Therefore, the teleconsultation platform can provide primary eye care for most patients and function as an essential direct screening for rest [22].

Besides, in this scenario, the prolonged use of digital devices for e-learning by children during the pandemic can lead to eye problems, including digital eye strain (DES). Thus, the study called DESK-3 analyzed a series of cases of acute acquired esotropia (AACE) in children attending online classes during the COVID-19 pandemic. Children aged 6 to 18 years with recent onset of esotropia with less than 1-month duration were evaluated. In total, eight children from the AACE were included in the study. The children's mean age was 12.5 ± 4.2 years. All eight were men. The average duration of smartphone use was 4.6 ± 0.7 hours per day. All children attended online classes for over 4 hours a day on a medium-sized 5.5-inch smartphone. Five children were emmetropic, one nearsighted, one pseudo myopia, and one farsighted. The deviation angle for near and distance was 48.1 ± 16.4 SD and 49.3 ± 15.9 SD, respectively. Seven children complained of horizontal diplopia in all eyes. Therefore, the extension of the use of smartphones for e-learning can lead to AACE in children [23].

Conclusion

According to global guidelines, it is imperative to establish more specifically the care of children with strabismus in the COVID-19 pandemic. Examination of children must be performed according to the protocol recommended by the guidelines. These measures are necessary, given that the pandemic can still have a long duration. Although various forms of strabismus can be treated conservatively, most require surgical intervention. However, strabismus can be treated conservatively for a short period with orthoptic

exercises, occlusion therapy, and prism glasses. General anesthesia is a critical part of pediatric ophthalmic practice and also poses among the greatest risks of transmission of SARS-CoV2.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

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