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Post-pandemic innovation: a six-session visual telerehabilitation program for children

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Abstract

The Covid-19 pandemic has led orthoptics to the practice of telematic rehabilitation with visually impaired children (VI). Previous research, on protocols developed during the peak of pandemic emergency, highlighted the importance of keeping similar characteristics of the traditional rehabilitation setting in the telematic one. While the world is moving forward from the pandemic, a new awareness about the importance of ICTs in healthcare has spread. Thus, visual telerehabilitation should be improved into a stand-alone method. The present work aims at proposing a systematization of visual telerehabilitation and suggesting how to test its effects. This paper presents a six-session visual telerehabilitation program with age-specific exercises, developed via Microsoft PowerPoint, training visual attention, visual-spatial motor coordination, visual pursuit, saccadic eye movement, visual search, eye-hand coordination. The sessions are provided via Microsoft Teams where the orthoptist and the child are engaged in a video call (via tablets and personal computers) with the screen-sharing option or showing slide presentations. Moreover, two tools to monitor the effectiveness of this protocol are presented and discussed: (i) ergo-perimetric evaluation; (ii) ecological evaluation provided by parents.

Keywords: *visual disability; children; visual rehabilitation; visual telerehabilitation; orthoptics*

Introduction

The Covid-19 pandemic has led healthcare to practice rehabilitation through ICTs devices (Varela-Aldás et al., 2021). Across a wide range of disabilities and diagnoses (Martinez et al., 2020), experts had to adapt the traditional rehabilitation protocols to the online environment (Das & Christy, 2021), within the innovative framework provided by Internet Communication Technology (ICTs). Since rehabilitation, for individuals with a Visual Impairment (VI), constitutes a powerful tool to gain and maintain autonomy and psychosocial wellbeing (Bittner et al., 2020), its transition into the telematic environment is particularly crucial in times of pandemics and after. Visual telerehabilitation has the advantage of sparing VI adults and children problems related to transportation and physical barriers to reaching the in-person rehabilitation setting. On the other hand, it implies possible difficulties in the use of technology because of the VI (Saltes et al., 2018). Accordingly with these two aspects, protocols alternating in-person and online sessions of visual rehabilitation should be considered the best option (Bittner et al., 2020).

The peak of the Covid-19 pandemic of 2020, and related socio-behavioral restrictions established by national governments, led orthoptics to the development of visual telematic protocols of visual rehabilitation (Senjam et al., 2021; Perasso et al., 2021; Perasso et al., 2022). Such pioneering tools responded to: (i) the need to counteract the already high risk for social isolation among VI people (Cochrane 2008) and the possibility of treatment dropout; (ii) the lack of international guidelines for telematic rehabilitation for VI children and adults (Saltes et al., 2018). Recent research (Perasso et al., 2021; Perasso et al., 2022) highlighted the importance of keeping similar characteristics of the traditional visual rehabilitation setting in the online one (e.g., time length of the session, therapeutic alliance), especially when the patient is a VI child.

However, those data refer to a telematic visual rehabilitation protocol urgently developed during the first Covid-19 lockdown in Italy (i.e., March-May 2020) (Perasso et al., 2021; Perasso et al., 2022) and, in literature there are not evidence yet about how to systemize and test visual telerehabilitation protocols' beneficial effects on VI patients. This aspect is fundamental given that, while the world is moving forward from the pandemic, a new awareness about the importance of ICTs in healthcare has spread in many domains of human daily life (e.g., education, work, social interactions, etc.). Consequently, improving visual telerehabilitation and making it a stand-alone method has become crucial in the orthoptic field as it could allow conducting rehabilitation for VI children and their families overcoming geographical distances.

Aims and objectives

The present work aims at proposing a systematization of visual telerehabilitation and suggesting how to test its effects. In particular, the work will present a six-session telerehabilitation protocol for VI children, driven by David Chiossone Foundation's (Genoa, Italy) orthoptists' focus group and collaboration. Two tools to monitor the effectiveness of this protocol are proposed and discussed: (i) ergo-perimetric evaluation; (ii) ecological evaluation provided by parents.

1.Methodology

1.1.The six-sessions visual telerehabilitation protocol

The visual telerehabilitation protocol developed by the four orthoptists of David Chiossone Foundation is composed of six sessions (one per week) of 30-40 minutes each. Six folders of exercises have been systematically organized on Microsoft Teams, with age-specific subfolders, progressively ordered in terms of difficulty. Orthoptists can consult an internal catalog categorizing the exercises in terms of format (e.g., Microsoft Power Point, Microsoft Word), session number, children's age, specific features (e.g., numbers, pictures, sounds), description of the activity, and if the parent's presence is required or not. The catalog has been developed with the aim to replicate the methodology long-term. The third session also comprehends exercises created with external digital resources (e.g., Wordwall.net). The exercises have been created to train the following abilities: saccadic movements, fixation, visual attention, visual search, visual pursuit, sustained attention, eye-hand coordination, visual spatial attention (see Perasso et al., 2021). Each session is provided via Microsoft Teams where the orthoptist and the child are engaged in a video call with the screen-sharing option or showing slide presentations. Children need to be connected via personal computers or tablets. Parents are provided with an instruction handbook to organize and manage the visual telerehabilitation sessions. For example, exercises in Word format often need to be printed from the children's home by sending them to the parents before the session.

1.2.Ergo-perimetric evaluation

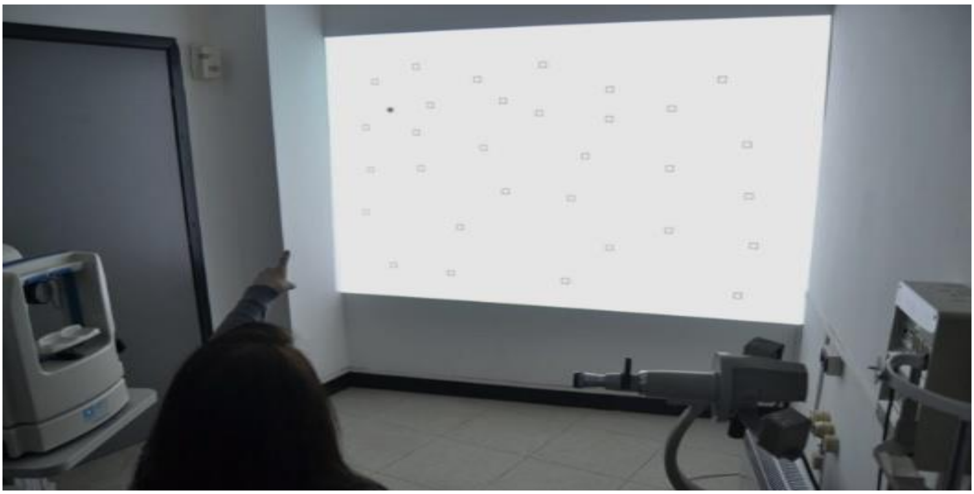

Fig.1 Ergo-perimetric evaluation of a VI child.

Ergoperimetry can represent a fundamental tool to monitor visual telerehabilitation because it allows to measure progresses in the patient with VI. To corroborate visual telerehabilitation efficacy the test should be repeated before and after the six sessions. Ergoperimetry is an assessment of the visual response of the patient that can be used as a benchmark to monitor how different types of patients respond to visual rehabilitation (Calabria et al., 1984). Ergoperimetry takes place in the orthoptist's setting in a semi-dark environment and consists of different visual tests, where stimuli are presented on black-and-white slides made in Microsoft PowerPoint and projected on a wall (Di Leo, 2014; Panizzi and Capris, 2016). The projector should be placed at a height that does not create shadows on the figures. The patient should sit 2 meters far from the wall where the slides - each 2 meters long and 1.5 meters high - are projected, in an area of 30° eccentricity (Figure 1).

Each slide presents easily recognizable and standardized static and kinetic stimuli: the patient sees on the wall a stimulus (target) moving amidst stationary stimuli scattered in the background, which presents salient features compared to the others. The slides may present, for example:

1) Shapes: a dot changes position in relation to static squares.
2) Playing cards: an ace changes position in relation to static picture cards.
3) Letters: a 'C' changes position in relation to static 'A's.
4) Numbers: a '4' changes position from the static '1'.
5) Words: the word “VOLO” (translated "FLIGHT") changes position in relation to the words “TAVOLO” (translated "TABLE").
6) Musical notes: a single note changes position in relation to double notes.

On each slide, the static stimuli are arranged randomly, scattered in the background, so that the patient selectively discerns the stimulus in the center, which constitutes the kinetic stimulus (aim/target), equivalent to the patient's fixation point. This stimulus disappears from the center to reappear at other points on the next slide: the patient's task is to gaze, identify, and verbally account for the position of the target (Figure 2, Figure 3).

From the patient's speed in searching for the target, across the different slides and types of stimuli, the patient's average reaction time can be derived. The projected figures subtend an octotype angle of 1/10 to ensure vision even for VI patients with a central scotoma.

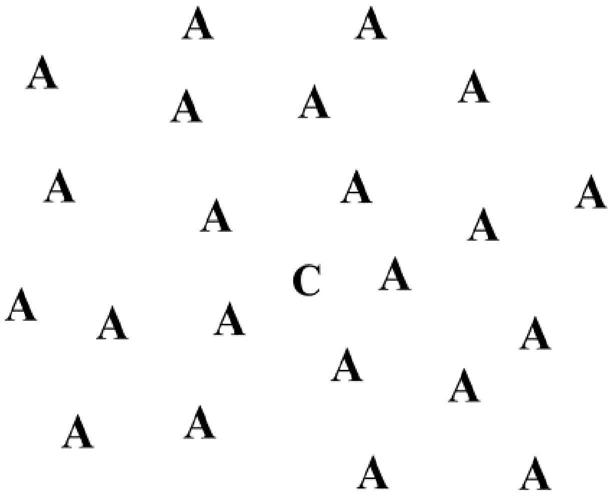

Fig. 2: Initial position of the kinetic stimulus “C”.

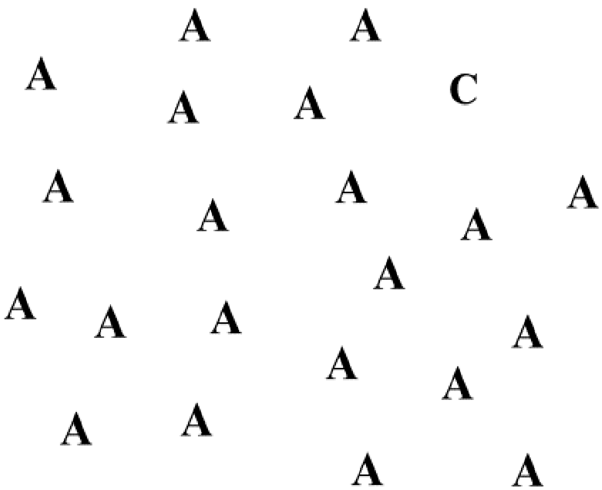

Fig. 3: The kinetic stimulus “C” appears into another position.

1.3.Ecological evaluation

To personalize visual telerehabilitation, an ad-hoc questionnaire should be administered to the parents of the VI child in order to gather ecological information about his/her visual abilities. In line with research analyzing parents of visually impaired children's feedback on orthoptic rehabilitation services (Jackel et al., 2019; Blackstone et al., 2021), these data may ameliorate the protocol by valuing parents as mediators of the orthoptists' alliance with VI children, also given that parents have to dispose and manage the telerehabilitation setting. An eight-item ad-hoc questionnaire is proposed (see Table 1) with practical examples of children's visual capacities in the family's daily life. The tool is a feasible solution to quickly gather corroborating information about the child's visual profile, and it can be administered online. Parents' responses are ordered on a Likert scale from 1=insufficient to 4=very good.

Item	Likert scale
1. Do you think that your son/daughter's ability to direct visual attention in a spontaneous way (e.g., directs his/ her gaze at you when you arrive in a room where he/she is playing) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
2. Do you think that your son/daughter's ability to maintain visual attention over time (e.g., follow the passage of a plane in the sky) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
3. Do you think that your son/daughter's ability to orient his/ her gaze in space (including right, left, and depth) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
4. Do you think your son/daughter's ability to adapt from light to dark and vice versa is:	1=insufficient; 2=sufficient; 3=good; 4=very good
5. Do you think that your son/daughter's ability to discriminate contrast, visually, (e.g., going downstairs discriminating steps) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
6. Do you think that your son/daughter's ability to look for something in space (e.g., looking for where the swing is in a playground where he/she has never been) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
7. Do you think that your son/daughter's ability to coordinate his/ her gaze with the movement of his/ her hand (e.g., follow a stimulus moving on a screen with his/ her index finger and eyes) is:	1=insufficient; 2=sufficient; 3=good; 4=very good
8. Do you think that your son/daughter's ability to use visual aids (such as glasses, magnifiers, etc.) is:	1=insufficient; 2=sufficient; 3=good; 4=very good

Table 1. Ad-hoc questionnaire for VI children's parents.

Conclusions

This work lays the theoretical and practical foundations (i) to systematize the visual telerehabilitation protocols that were initially created to cope with the pandemic emergency and (ii) for future research to test and monitor the benefits of telerehabilitation in children with VI. Improving visual telerehabilitation for VI children is a crucial process to catalyze what orthotics' learnt from the Covid-19 pandemic emergency in the application of ICTs with this specific population. New telerehabilitation protocols may also facilitate families' access to children's visual rehabilitation treatments, overcoming geographical distances. Systemizing previous material from the pioneering tools, driven from the global health emergency period, is the first step toward making telerehabilitation a stand-alone method. The integration of ergo-perimetric evaluation and ecological evaluation (by parents) provides crucial instruments to corroborate and monitor visual telerehabilitation in children. The current work presented several limitations related to the application of a visual telerehabilitation protocol: issues can arise from the use of the Microsoft Teams platform by the VI patient and his/her caregiver. Such issues can be solved with an initial familiarization with Teams. Notwithstanding these limitations, the present paper lays the ground for further investigation of visual telerehabilitation's effectiveness on children, which should be tested statistically by comparing the outcomes of three types of protocols (e.g., visual telerehabilitation, traditional visual rehabilitation, and mixed-mode visual rehabilitation).

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