Accommodative Insufficiency: A Case Study

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Abstract— Background: *Accommodative insufficiency occurs when the amplitude of accommodation (AA) is lower than expected for the patient's age and is not due to sclerosis of the crystalline lens. Patients with accommodative insufficiency usually demonstrate poor accommodative sustaining ability.* **Case Presentation**: *Case report of a 10-year-old patient with inadequate accommodation where primary treatment with the use of additions was not effective. The case is presented with the clinical data of the first evaluation, made after the use of positive additions and later the patient performs visual therapy sessions, where he obtained the values of the norm for age, for which a second evaluation is presented with the values obtained after visual therapy sessions.* **Conclusion**: *With the completion of the visual therapy sessions, the patient recovered the accommodative capacity and no longer needed positive additions.*

Keywords— Accommodation, accommodative insufficiency, accommodation facility, additions, visual therapy, vergencies.

I. INTRODUCTION

Accommodative Insufficiency (AI) is the condition in which the patient has difficulty stimulating accommodation, having as characteristic finding an accommodative amplitude below the lower limit of the expected value for the patient's age[1,2]. AI is the most common form of accommodative dysfunction. Studies of school-age children have found an AI prevalence range from 2.3% to 17.3%[3]. This difference values may be related to differences in the diagnostic criteria used. Some authors have emphasized the role of accommodative and binocular dysfunctions in prescribing guidance in prescribing eyeglasses and / or visual therapy[3].

People with inadequate accommodation have characteristic symptoms that manifest themselves mainly during reading periods and close tasks. These symptoms may include blurred vision, fatigue, drowsiness, loss of text comprehension, heaviness around the eyes, reading problems, eye fatigue, headaches, focusing difficulties when changing focus distance, difficulty performing school tasks, diplopia, rubbing eyes, red eyes, feeling of sands in the eyes and dry eye[4].

In addition to the symptoms presented, this type of disorder also presents characteristic signs from which direct and indirect measures can be differentiated. In direct measurements, we consider those that stimulate accommodation directly. These measurements in a situation of inadequate accommodation will result in reduced accommodation amplitude (AA), high monocular estimation retinoscopy (MEM), focusing difficulty with -2.00 negative spherical lenses in monocular. In indirect measurements, we consider those that, by means of measurement, stimulate vergences, also having an associated accommodative factor,

such as the Negative Relative Accommodation (NRA) measurement, which will be reduced in patients with accommodative insufficiency, and accommodative flexibility, where we may find difficulties focusing with negative lens - 2.00D. According to Scheiman M. & Wick B. 2014, the main treatment plan in this type of binocular vision disorder involves the use of positive additions and as a secondary treatment plan, the realization of visual therapy. Studies show that treatment with positive additions does not produce better results than treatment performed in the office.[5,6]

However, it is important to note that treatments performed with additions equal to + 2.00D did not lead to improvements in accommodation and that an addition of +1.00 allows for improved accommodation. For additions of + 2.00D and above there is only one near vision correction that has no effect on accommodative insufficiency treatment[7,8].

According to Scheiman, M. & Wick, B.2014, treatment for accommodative insufficiency should follow the following sequence: a) Lens prescription, unbalanced refractive errors will cause eye fatigue, often minor corrected errors, hyperopia and astigmatisms, end patients' symptoms immediately; b) Additions, the use of positive additions in the treatment of accommodative insufficiencies may be beneficial in some situations and ineffective in others, and visual therapy may make a difference in this type of patient. c) Visual therapy, considered secondary treatment in this type of alterations, should be used when the patient does not respond to treatment with additions or in addition to treatment with additions. Usually between 12 to 24 visual therapy sessions are required.[9]

Visual therapy, in these cases of accommodative insufficiency, can be divided into 3 phases: a) Phase 1, which aims to establish a working relationship with the patient, to develop the various feedback mechanisms used, to normalize the range of accommodation and ability to stimulate accommodation; b) Second Phase, normalize the ability to stimulate and relax the accommodation, increase the speed of the accommodative response, normalize the NFV amplitudes, normalize the PFV facility, normalize the NFV facility; (c) Phase Three, Integrate accommodative capacity with binocular vision techniques, develop the ability to change the demand for convergence and divergence, and integrate vergence exercises with versions and balconies.

II. CASE REPORT

A 10-year-old male patient. His first appointment with an ophthalmologist at the age of 8. At the age of 9, he went to the ophthalmologist suffering from a headache once again and

started wearing executive bifocal lenses with an addition of + 1D.

Since then the addition has always been increasing until 3D, with refractive changes every 6 months and always accompanied by headache. When His changed the optical compensation changed, the headache would pass, but then eventually the headache back again. At the last Ophthalmology appointment in 2017, when he was 10 years old, the doctor prescribed a new degree which increased the addition to +4.00 D. The patient mother went to an optician to order the lenses and is then advised to seek a second opinion, thus not updating the prescription.

In the anamnesis, the mother states that there is no family or personal history relevant to the case, and also that the child doesn't take any kind of medication. His main complaints are frequent headaches, concentration difficulties associated with the use of near vision and intermediate vision. It also refers to the fact that a Computed Axial Tomography was done and to evaluate possible causes for the presented headaches, where nothing was detected.

The patient reports that whenever he changed the degree, the headaches passed, but over time began again, with spacing every 6 months and consequent increases in close addition.

Based on the anamnesis performed, a complete assessment of the patient's binocular vision was performed, as shown in table 1.

TABLE 1. Binocular Evaluation

Gender: Male			
Age: 10 years			
Glasses Prescription: yes			
Date: 8/03/2017			
Near acuity	**Distance acuity with prescription**		
With sight correction	**Right eye**	**Left Eye**	
OD: +5.50D 10/10 **OE:** +5.75D 10/10 **Without sight correction:** **Right eye:** 3/10 **Left eye:** 3/10	+2.50D ADD+4.00 – 10/10	+2.75D ADD +4.00 – 10/10	
Cover Test	**Near** Orthophoria	**Distance** Orthophoria	
Worth Test	Fusion		
AA	**Right Eye:** 2.5D	**Left Eye:** 2.5D	**Both eyes:** 2.5
PPC	7/12cm		
Accommodative facility with flipper +/-2.00	**Right eye:** 0 cpm; fail monocular accommodative with minus lenses **Left eye:** 0 cpm; fail monocular accommodative with minus lenses **Both eyes:** 0 cpm; fail monocular accommodative with minus lenses		
Fusional Vergence	**Distance:** **PFV** 20/10 **NFV** 10/6	**Near:** **PFV** 18/6 **NFV** 8/4	
Accommodation test	**PRA:** +3.00	**NRA:** Fail	
MEM	+1.00D		
Stereopsis Titmus	40´´arc		
synoptophor	Objective angle=0° Subjective angle=0° Abduction: 5° Adduction: 15		

Through the analysis of the collected data, in the assessment of the patient's binocular vision, it is possible to observe that there is a lack of accommodation. In these cases, the most common characteristic finding is the accommodation amplitude values quite low for the patient's age. The minimum value for the patient's age would be according to Hofstetter's equation:

$$AA\ minimum = 15 - \frac{1}{3}*10$$

AA minimum = 11,7 D

The patient without close addition, who was used to using, had values of 2.5D, which is much lower than the minimum value for his age. In addition to this characteristic finding, the presence of a high accommodative delay is also common in these cases, which is revealed by the observation of the + 1.50D MEM and a near low convergence point (PPP). We observed changes in the accommodative tests performed, both direct and indirect measurements of Positive Relative Accommodation (ARP) and monocular and binocular accommodative flexibility. Measurements of Positive and Negative Fusional vergences are within the values of the standards.

After the first session of visual therapy a change in the patient's optical compensation was made because the patient felt that at the end of the treatment he could see better and asked if it was possible to withdraw the addition, the addition did not bring any comfort. since it made visual comfort worse.

In this case the patient would have a visual acuity of less than 10/10, but given the situation would be the best option, since the patient has completely ceased to accommodate with the additions it would be important to encourage accommodation during the exercises performed in the cabinet and The use of the additions would eventually delay treatment.

The first session of visual therapy was held on March 8, 2017, the exercises were performed with prescription away from the patient. The patient performed 12 visual therapy sessions, which were held twice a week for a month and a half. Each treatment session lasted an average of 40 minutes.

At the end of the treatments it was necessary to update the graduation again, changing the patient to: OD + 2.00D and EO: + 2.25D. After a period of 15 days, in which the patient only exercised at home, in order to maintain the values obtained without any setbacks, a new evaluation was made to verify the state of binocular vision for which the following values are presented by observing of the following assessment sheet:

TABLE 2. Binocular Evaluation

Gender: Male		
Age: 10 years		
Glasses Prescription: yes		
Date: 08/2017		
Near acuity	**Distance acuity with prescription**	
With sight correction	**Right eye**	**Left Eye**
OD: +5.50D 10/10 **OE:** +5.75D 10/10 **Without sight correction:** **Right eye:** 3/10 **Left eye:** 3/10	+2.00D – 10/10	+2.25D – 10/10
Cover Test	**Near** Orthophoria	**Distance** Orthophoria
Worth Test	Fusion	

AA	Right Eye: 12D	Left Eye:12D	Both eyes:12
PPC	4/6cm		
Accommodative facility with flipper +/-2.00	Right eye: 8 cpm; Left eye: 8 cpm; Both eyes: 11 cpm;		
Fusional Vergence	Distance: PFV 20/12 NFV 8/4	Near: PFV 35/20 NFV 12/6	
MEM	+0.50D		
Stereopsis Titmus	40´´arc		
synoptophor	Objective angle=0° Subjective angle=0° Abduction: 7° Adduction: 30		

III. DISCUSSION

The recommended treatment was 12 to 24 visual therapy sessions in conjunction with the required changes in patient grading throughout the treatments. Treatment was based on the 3 stages of treatment of accommodation insufficiencies according to Scheiman. In this case and according to the values obtained in MEM the addition greater than + 1.00D has no effective value for treatment. Given the patient's history it would be right to keep an addition of +1.00 so that the patient could see well and reconcile this treatment with the completion of the visual therapy sessions.

The patient in 12 visual therapy sessions was able to regain accommodative capacity and is not currently dependent on optical compensation for near vision. The accommodative capacity has been restored and is within normal values for the patient's age, according to the Hofstetter's 18-⅓ age equation.

The fusional vergences are within the normal range according to the references and authors consulting[2,10].

The patient was recommended to perform evaluations every 6 months and to perform exercises at home so that there was no regression of the achieved values.

In the last prescription made on January 2, 2018, the patient had the following prescription: OD + 1.75 and EO: +1.75.

IV. CONCLUSION

It is important to consider the age of the patient and the functions that are normal for their age. A 10-year-old should be able to accommodate. The use of positive additions in this case was not enough to solve the problem. Ideally, a combination of the primary treatment plan, with a positive addition of +1.00 and complementary to visual therapy, has been made from the outset.

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