



## Retinitis Pigmentosa and Ocular Motility Alterations: New Frontiers, Review

Arrico L\*, Grimaldi C, Cecchetti D, Crevatin CA and Compagno S

Department of Sense Organs, Glaucoma Service, Clinical Ophthalmology, University of Rome "Sapienza", Italy

### Abstract

**Purpose:** To carry out a review of the literature on alterations in extraocular motility in Retinitis Pigmentosa (RP), focusing on the possible genetic basis of ocular alterations.

**Design:** Systematic review

**Methods:** The search of publications was carried out using the databases: Scopus, PubMed, Google Scholar, Web of Science, considering clinical cases, case reports, and systematic reviews of ocular motility alterations in the Retinitis Pigmentosa in the literature. The words: "ocular motility alterations, Retinitis Pigmentosa, orthoptic evaluation, case reports, clinical cases, systematic reviews" were used.

**Results:** A total of 2 articles from 2006–2022 were retrieved: No other ocular motility alterations clinical cases linked to RP were found before. Particularly, a study conducted on patients affected by typical RP showed that there was an impaired motility in 50% of them. Since RP is a genetically determined disease, in reference to the studies analyzed, the absence of eye movement disorders in a percentage of the sample could be related to the different penetrance of the disease that determines the existence of healthy carriers.

**Conclusion:** Therefore, it would be important to search for a possible correlation between the genetic mutations involved in this hereditary disorder and the deficits in extraocular motility, in order to make an early diagnosis of RP in genetically predisposed subjects. The existence of alterations of extraocular motility in subjects with RP, indicates that a careful orthoptic screening can allow a further contribution to an early diagnosis of this disease, especially in subjects with positive family history and healthy carriers.

**Keywords:** Retinitis pigmentosa; Ocular motility; Orthoptic evaluation; Review; Genetica

### OPEN ACCESS

#### \*Correspondence:

Loredana Arrico, Department of Sense Organs, Glaucoma Service-Eye Clinic, University of Rome "Sapienza", Via del Policlinico 155, 00161 Rome, Italy, Tel +39 3356900888; Fax +39 0649975304;  
E-mail: loredana.arrico@uniroma1.it

**Received Date:** 07 Sep 2022

**Accepted Date:** 20 Oct 2022

**Published Date:** 24 Oct 2022

#### Citation:

Arrico L, Grimaldi C, Cecchetti D, Crevatin CA, Compagno S. Retinitis Pigmentosa and Ocular Motility Alterations: New Frontiers, Review. Ann Clin Case Rep. 2022; 7: 2320.

**ISSN:** 2474-1655.

**Copyright** © 2022 Arrico L. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### Abbreviations

RP: Retinitis Pigmentosa; EOM: Extraocular Motility; ERG: Electroretinography

### Introduction

Retinitis Pigmentosa (RP) is a genetically determined retinal disease characterized by the developmental and irreversible degeneration of photosensitive retinal cells, resulting in progressive loss of night vision and peripheral visual field. The resulting reduction in visual acuity in both eyes leads to complete blindness in most cases [1,2]. The typical form of RP is characterized by primary degeneration of the rod photoreceptors with secondary degeneration of the cones; therefore, it is described as a "rod-cone dystrophy." This justifies why patients show only night blindness at first and visual deterioration later in daylight [3,4]. The clinical form called "cone-rod dystrophy" has predominant involvement of the cones (central retinal photoreceptors). Decreased visual acuity consequently predominates over visual field loss [1,5].

The worldwide prevalence of RP is about 1 in 4000 healthy people for a total of more than 1 million people affected. In the USA the prevalence is about 1:3500 – 1:4000 with significant differences between states; in Switzerland 1:7000; in China 1:4016; in Norway 1:4440; in Israel 1:4500 [6]. The disease can be inherited as autosomal-dominant (approximately 30% to 40% of cases), autosomal-recessive (50% to 60%), or X-linked (5% to 15%) [6]. It is common to think of RP as a purely genetic disorder, in whose diagnosis genetic counselling as well as fundus oculi and Electroretinography (ERG) examinations play a key role. However, a 2015 study we conducted at the Center for Pediatric Ophthalmology and Strabology of the Ophthalmology Clinic of the A.O.U.

Policlinico Umberto I, associated with the University of Rome "La Sapienza", showed that in relation to patients with this disease, it is possible to detect alterations in Extraocular Motility (EOM) on a probable genetic basis. This finding frames the importance of orthoptic evaluation as a screening tool for this clinical picture that, currently, does not have a real therapy, but relies on experimental treatments, forcing the individual to a narrow view of reality. In view of the progressive course of RP, the idea was born to carry out a review of the literature on this topic little evaluated, focusing on the possible genetic basis of ocular alterations.

## Material and Methods

The search of publications was carried out using the databases: Scopus, PubMed, Google Scholar, Web of Science, considering clinical cases, case reports, and systematic reviews of ocular motility alterations in the Retinitis Pigmentosa in the literature. The words: "ocular motility alterations, Retinitis Pigmentosa, orthoptic evaluation, case reports, clinical cases, systematic reviews" were used. Publications in English were considered.

## Results

A total of 2 articles from 2006–2015 were retrieved: No other ocular motility alterations clinical cases linked to Retinitis Pigmentosa were found before. In the literature a study has been found that highlights how Retinitis Pigmentosa is associated with alterations in extraocular motility: It was a case-report of a 31-years-old patient who presented cyclic exotropia of the left eye of 4 years duration that alternated every 24 h, associated with RP (Hwang JM, Kim "Cyclic exotropia associated with Retinitis Pigmentosa"; March 2006). The patient showed an orthotropia and a comitant left exotropia of 30 prism diopters at distance and 25 prism diopters at near in the primary position on exotropic day with a cycle of 48 h [8]. The other one has been our pilot study conducted in 2015 [7], which considered a sample of 25 individuals (of whom 69.5% affected by typical RP and the remaining percentage affected by associated syndromes) with an average visual acuity of 6/10. The results showed that there was an impaired motility in 50% of patients in this inherited disorder, this alteration of the ocular motility was not, however, due either to a height refractive defect (size medium – low myopia: - 1 diopter  $\pm$  3 SD) or to a binocular vision, severely impaired (visual acuity, motor fusion and stereopsis were normal or within commonly accepted limit values). These ocular motility disorders were ascribed to a genetic origin factor [7]. The cover test about the vertical deviation in near distance showed an r/l in 3.45% and an l/r in 6.9%. The assessment of Extraocular Motility (EOM) showed that 39.1% of the sample had a sever hyperfunction of the Inferior Oblique of the right eye and a severe hyperfunction (34.5%) of the Superior Oblique of the left eye; 21.8% had a moderate hyperfunction of the right Superior Oblique with a moderate percentage of hypofunction of 17.5% for the Superior Oblique of the left eye. However, 30.5% showed a serious hypofunction of the Superior Rectus of both eyes; 21.7% of the sample showed a hyperfunction in both eyes of the Inferior Rectus [7].

## Discussion

In the literature, the study of 2006 [8] has highlighted how RP is associated with alterations in extraocular motility: It was a case-report of a 31-year-old patient who presented cyclic exotropia associated with RP. Cyclic exotropia may occur in patients with Retinitis Pigmentosa, an association that to the best of knowledge has not been previously reported in the English ophthalmic literature.

However, in our opinion, this study does not specify the clinical form of RP and still considers poor visual acuity (light perception) in the exotropic eye, which was affected by the deficit of extraocular muscles. This study, anyway, highlights a possible relation between ocular motility alterations and Retinitis Pigmentosa. In the second study, every patient with RP underwent orthoptic evaluation in association with the standard diagnostic protocol: So, we have seen how fundamental the evaluation of the extraocular musculature is in the screening phase of this pathology. In particular, our pilot study conducted in 2015 [7], considered a sample of 25 individuals (of whom 69.5% affected by typical RP and the remaining percentage affected by associated syndromes) with an average visual acuity of 6/10; it revealed the presence of altered EOM in 50% of patients with this hereditary disorder (recording orthophoria in the remaining 50% of patients). The alterations in EOM, however, were neither due to a high refractive defect nor to severely impaired binocular vision (visual acuity and stereopsis were normal or within commonly acceptable limits) and seemed to exclude involvement of the medial rectus and lateral rectus muscles in right and left lateroversion. Unlike the previous study considered, this study makes more certain any correlation that exists between ocular muscle deficit and Retinitis Pigmentosa because of the inclusion and exclusion criteria that we have chosen. Inclusion criteria were: Age between 6 and 80 years; visual acuity between 1/10 and a maximum of 10/10 (through the Snellen optotype); patients with the typical form of non-syndromic RP and syndromes associated with various types of pigmentary retinopathy (Usher syndrome, Cockayne syndrome, Best's disease, etc.); patients with suspected RP that, through a careful history the presence of RP in other family members (brother, cousin and grandfather) has been discovered. Exclusion criteria were: Patients who had undergone ocular surgery; patients affected by systemic, vascular, and neurodegenerative diseases that may affect orthoptic assessment; presence of Humphrey electronic field of view (CV)  $<10^\circ$  [7].

## Conclusion

It can be said that Retinitis Pigmentosa is one of the most disabling diseases, since in its advanced stages can lead to a condition of severe low vision or blindness, progressively compromising the normal performance of activities of daily life of an individual. RP determines significant repercussions on the social life and relationships of patients, from the earliest stages of development in terms of schooling and inclusion in the working world. The most rapidly compromised aspects are the autonomy of mobility and orientation of the person. The state of discomfort that the patient feels is mainly due to the fact that he constantly sees the world as through a keyhole. Although the literature does not have a large number of articles on the association that exists between the deficits of the EOM and RP, the mere fact that this correlation has been demonstrated could be an important step to help prevent the onset of certain symptoms, in predisposed individuals, when the disease is still in silent phase.

In conclusion, according to the results obtained from the studies that we wanted to analyze in this article, the existence of alterations of extraocular motility in subjects with Retinitis Pigmentosa, indicates that a careful orthoptic screening can allow a further contribution to an early diagnosis of this disease, especially in subjects with positive family history and healthy carriers. In fact, since RP is a genetically determined disease, in reference to the studies analyzed, the absence of eye movement disorders in a percentage of the sample could be related to the different penetrance of the disease that determines

the existence of healthy carriers. Since the disease presents complex welfare issues and is often related to significant risk of procreative hereditary transmission, in the future, it would be desirable to extend the study of the alterations of the EOM in association with RP to define with greater certainty, by expanding the sample, if the alterations of EOM can be recorded at the expense of all the muscles as the disease progresses, if these same alterations can be related to all types of RP. On the basis of these questions, it is important to search for a possible correlation between the genetic mutations involved in this hereditary disorder and the deficits in EOM, in order to make an early diagnosis of RP in genetically predisposed subjects.

## References

1. Bunker CH, Berson EL, Bromley WC, Roderick TH. "Prevalence of retinitis pigmentosa in Maine". Am J Ophthalmol. 1984;97(3):357-65.
2. Novak-Laus K, Kukuli S, Zoric-Geber M, Bastaic O. "Primary tapetoretinal dystrophies as the cause of blindness and impaired vision in the Republic of Croatia". Acta Clinica Croatica. 2022;41:23-7.
3. Ammann F, Klein D, Franceschetti A. "Genetic and epidemiological investigations on pigmentary degeneration of the retina and allied disorders in Switzerland". J Neurol Sci. 1965;2(2):183-96.
4. Berson EL, Rosner B, Sandberg MA. "A randomized trial of vitamine A and vitamine E supplementation for Retinitis Pigmentosa". Arch Ophthalmol. 1993;111(6):761-72.
5. Boughman JA, Conneally PM, Nance WE. "Population genetic studies of Retinitis Pigmentosa". Am J Hum Genet. 1980;32(2):223-35.
6. Jay M. "On the heredity of Retinitis Pigmentosa". Br J Ophthalmol. 1982;66(7):405-16.
7. Migliorini R, Comberiati AM, Galeoto G, Fratipietro M, Arrico L. "Eye motility alteration in retinitis pigmentosa". J Ophthalmol. 2015;2015:145468.
8. Hwang JM, Kim J "Cyclic exotropia associated with Retinitis Pigmentosa". Graefes Arch Clin Exp Ophthalmol. 2006;244(11):1549-51.