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## Original article

# Pseudoexfoliation signs in the anterior segment assessed by optical coherence tomography and Scheimpflug device<sup>☆</sup>

J.I. Fernández-Vigo<sup>a,b,\*</sup>, L. de-Pablo Gómez de Liaño<sup>b,c</sup>, I. Sánchez-Guillen<sup>b</sup>,  
A. Macarro-Merino<sup>b</sup>, C. Fernández-Vigo<sup>b</sup>, J. García-Feijóo<sup>a</sup>, J.A. Fernández-Vigo<sup>b,d</sup>

<sup>a</sup> Departamento de Oftalmología, Hospital Universitario Clínico San Carlos, Instituto de Investigación Sanitaria San Carlos (IdISSC), Madrid, Spain

<sup>b</sup> Centro Internacional de Oftalmología Avanzada, Madrid, Spain

<sup>c</sup> Departamento de Oftalmología, Hospital Universitario 12 de Octubre, Madrid, Spain

<sup>d</sup> Departamento de Oftalmología, Universidad de Extremadura, Badajoz, Spain

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## ABSTRACT

**Objective:** To evaluate different anterior segment parameters in eyes with pseudoexfoliation (PSX), fellow eyes, and controls using optical coherence tomography and a Scheimpflug imaging system.

**Methods:** Three groups were studied: 44 eyes of 44 patients with PSX, 30 clinically unaffected fellow eyes, and 148 eyes of 148 healthy controls. The anterior chamber depth and volume, corneal volume and thickness, pupil diameter and corneal densitometry were measured using a Scheimpflug imaging system (Pentacam, Oculus Inc.; Wetzlar, Germany). The angle width, the length and area of the trabecular meshwork, and the iris thickness were measured using an optical coherence tomography RTVue 100 device (Optovue, Fremont, CA, USA). The presence of PSX deposits was also assessed by OCT.

**Results:** There were no differences in the anterior chamber volume or depth in the corneal volume or central thickness ( $p \geq 0.228$ ). The corneal densitometry was similar between PSX and fellow eyes; however it was greater than in the control group ( $p < 0.001$ ). As regards the parameters measured by OCT, there were no differences in the angle width or in the trabecular meshwork size between the 3 groups; however, the iris was thinner in controls ( $p = 0.005$ ). In all patients the PSX deposits were correctly visualized by OCT after the identification by biomicroscopy.

**Conclusions:** There were no differences in the anterior segment biometric measurements between patients with PSX and controls, although the corneal densitometry and iris thickness were greater in the PSX and fellow eyes groups.

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\* Corresponding author.

E-mail address: [jfvigo@hotmail.com](mailto:jfvigo@hotmail.com) (J.I. Fernández-Vigo).

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## Evaluación de los signos de la pseudoexfoliación en el segmento anterior mediante tomografía de coherencia óptica y cámara de Scheimpflug

### RESUMEN

#### Palabras clave:

Pseudoexfoliación  
Glaucoma  
Tomografía de coherencia óptica  
Cámara de Scheimpflug  
Ángulo iridocorneal

**Objetivo:** Evaluar diferentes parámetros del segmento anterior en ojos con pseudoexfoliación (PSX), ojos contralaterales y controles mediante tomografía de coherencia óptica (OCT) y cámara Scheimpflug.

**Métodos:** Se estudiaron 3 grupos: 44 ojos de 44 pacientes con PSX, 30 ojos contralaterales no afectados y 148 ojos de 148 controles sanos. Mediante la cámara de Scheimpflug (Pentacam, Oculus Inc.; Wetzlar, Alemania) se midieron la profundidad y volumen de la cámara anterior, volumen corneal y paquimetría, diámetro pupilar y densitometría corneal. Mediante OCT RTVue 100 (Optovue, Fremont, CA, EE. UU.) se midieron la abertura angular, la longitud y el área de la malla trabecular, el grosor del iris, y se valoró la visualización de depósitos PSX.

**Resultados:** No se observaron diferencias en cuanto a la profundidad ni volumen de la cámara anterior, ni en el volumen corneal o paquimetría ( $p \geq 0,228$  en todos los parámetros) entre grupos. Sin embargo, la densitometría corneal fue mayor en PSX y en los ojos contralaterales que en el grupo control ( $p < 0,001$ ). En cuanto a los parámetros de OCT no existieron diferencias en la abertura angular ni en el tamaño de la malla entre los 3 grupos, siendo el grosor del iris menor en controles ( $p = 0,005$ ); identificándose en todos los pacientes el depósito PSX mediante OCT.

**Conclusiones:** No se detectaron diferencias entre las medidas biométricas del segmento anterior entre los pacientes con PSX y controles, salvo en el caso de la densitometría corneal central y el grosor del iris que fueron mayores en el grupo con PSX y en los ojos contralaterales.

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## Introduction

The pseudoexfoliation syndrome (PXS) is a systemic condition with ophthalmological expressions. In the ocular globe, pseudoexfoliative material can deposit in various anterior segment structures. The nature of this grayish material is mainly fibrillary with amorphous material. The composition of these fibers is diverse and includes basal membrane components as well as enzymes related to extracellular matrix maintenance.<sup>1,2</sup>

PXS is a clinically important entity as it is the most frequent cause of open angle secondary glaucoma in the world<sup>1-3</sup> and is highly prevalent in Spain.<sup>4,5</sup> It is associated to poor midriasis and zonular weakness as well as biochemical abnormalities such as hyperhomocysteinemia and systemic diseases compromising the cardiovascular and central nervous systems.<sup>1,6,7</sup>

The diagnosis of PXS is based on visualization through biomicroscopy of typical signs such as the presence of pseudoexfoliative material in the lens anterior capsule, iris and corneal endothelium which in some cases could go unnoticed. Involvement is usually bilateral but asymmetric.<sup>2,6-8</sup>

The development of various ophthalmological imaging technologies in recent years, mainly the Scheimpflug camera and optic coherence tomography (OCT) aroused the interest of numerous authors for supplementing clinic diagnostic of typical PXS signs leading to new findings considered to be associated to this entity.<sup>9-12</sup> In addition, said new diagnostic systems could contribute to enlarge the physiopathological knowledge of the process and its expressions as well as

the changes produced by PXS in clearly observable structures (anterior lens, iris and endothelium) and measurable with OCT (iridocorneal angle, trabecular mesh and iris thickness). However, said new findings associated to PXS with the Scheimpflug camera, i.e., alterations in pachymetry, corneal transparency, anterior chamber dimensions among others are at present being discussed in the literature with contradictory results.<sup>2,3,9,10,12,13</sup> Accordingly, the objective of the present study is to carry out a detailed analysis of the various structures comprising the anterior segment in patients with PXS, fellow eyes without apparent PXS and healthy controls by means of the Scheimpflug camera and OCT for studying possible alterations.

## Subjects, material and methods

A transversal study comprising 44 eyes of 44 patients with PXS, 30 fellow eyes without apparent PXS and 148 eyes of 148 healthy controls. The patients were recruited consecutively between those who visited for a checkup between February 1, 2016 and February 1, 2017. The study fulfilled the principles of the Helsinki declaration and was approved by the Ethics Committee of the hospital. After complete clinic history and ocular examination, informed consent was obtained from patients fulfilling the inclusion criteria.

Inclusion criteria for all groups were age over 55 and Caucasian ethnicity. Patients were classified in 3 groups by an experienced observer (JAFV) on the basis of anterior biomicroscopy appearance: (1) eyes with PXS: assessment under

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