

## **Malfunctioning cones and remedial tinted filters**

*Giuseppe Barbolini, Andrea Lazzerini, Luigi Alberto Pini, Modena; Fritz Steiner, Dornach; Giancarlo Del Vecchio, Mario Migaldi, Gian Maria Cavallini, Modena*

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### **Abstracts**

#### **English**

#### **Malfunctioning cones and remedial tinted filters**

**Objective:** To compare photophobic migraine patients (CM) with photophobic patients without headache in regard to the incidence of dysfunctional cones due to Irlen Syndrome.

**Design:** Prospective, observational case-control study.

**Patients:** Three study-groups (20 subjects each) were recruited as follows: (1) photophobic patients suffering from chronic migraine (CM); (2) photophobic patients without headaches; (3) healthy subjects.

**Methods:** The photophobia was evaluated as total error score (TES) at Farnsworth-Munsell 100 hue test and by electroretinography.

**Results:** About 85% of the photophobic tested patients were suffering from Irlen Syndrome (IS). Tinted filters, shifting daylight towards blue or towards green/red, markedly reduced the photophobic discomfort. The benefit was more evident in CM patients ( $p < 0.05$  ANOVA).

**Conclusions:** IS appears to be a hereditary disease related to a sectorial reduction in cones photopigment. There was a high incidence of IS in the CM patients, and these mainly responded well to tinted filters prompting further research.

**Key words:** photophobia, chronic migraine, Irlen Syndrome, tinted filters, electroretinogram.

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### **Italiano**

#### **Disfunzione dei coni e il trattamento con filtri colorati**

**Obiettivo:** Confrontare pazienti affetti da emicrania cronica con pazienti fotofobici esenti da cefalea rispetto all'incidenza della disfunzione dei coni da sindrome di Irlen nei due gruppi.

**Pazienti:** Sono stati indagati 3 gruppi di 20 pazienti ciascuno suddiviso nel modo seguente: (1) pazienti fotofobici affetti da emicrania cronica (CM); (2) pazienti fotofobici esenti da cefalea; (3) soggetti sani e non fotofobici (controlli). Metodi: La fotofobia è stata valutata come punteggio totale di errori (TES) al test Farnsworth-Munsell 100 e mediante elettroretinografia.

**Risultati:** L'85% circa dei pazienti fotofobici è risultato affetto da Sindrome di Irlen (IS). L'impiego di filtri colorati, in grado di spostare la luce diurna verso il blu o verso il verde/rosso ha ridotto fortemente il disagio fotofobico in modo più evidente nei pazienti con CM ( $p < 0.05$  ANOVA).

**Conclusioni:** L'IS sembra da considerare un difetto ereditario dovuto ad una perdita settoriale del fotopigmento dei coni. L'alta frequenza dell'IS nei pazienti con CM, che spesso traggono giovamento dall'impiego di filtri colorati, incoraggia a proseguire le ricerche al riguardo.

**Keywords:** Fotofobia, Emicrania cronica, Syndrome di Irlen, filtri colorati, fotopigmento, elettroretinografia

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### **Français**

#### **Disfonction des cônes et traitement par des filtres colorés**

**But** : comparer des patients photophobes, souffrant de migraine chronique (CM), et des patients photophobes sans céphalées pour déterminer l'incidence de cônes photorécepteurs défaillants du fait d'un syndrome d'Irlen dans ces groupes.

**Etude** : Observation prospective cas-témoins

**Patients** : trois groupes ont été recrutés :

1) patients photophobes, migraineux chroniques, 2) patients, photophobes sans céphalées, 3) témoins exempts de symptômes.

**Méthodes** : évaluation de la photophobie par le score total d'erreurs au test Farnsworth Munsell 100 Hue et par électrorétinographie.

**Résultat** : environ 85 % des personnes photophobes souffraient des symptômes du syndrome d'Irlen (IS). Les filtres colorés utilisés qui modifient la lumière du jour vers le bleu ou le vert/ rouge réduisaient nettement la gêne à la lumière. Le bénéfice des verres filtrants était significativement supérieur chez les patients photophobes migraineux ( $p < 0.05$ , ANOVA).

**Conclusion** : Le syndrome d'Irlen semble être une maladie héréditaire due à une réduction sectorielle du pigment photosensible des cônes. L'étude a démontré une grande incidence du syndrome d'Irlen chez les patients migraineux chroniques qui répondaient particulièrement bien aux filtres colorés. Il conviendrait de mener d'autres études pour approfondir cet aspect.

**Mots clés** : photophobie, migraine chronique, syndrome d'Irlen, filtres colorés, électrorétinogramme

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### **Deutsch**

#### **Dysfunktion der Zapfen und Behandlung mit Farbfiltern**

**Ziel:** Vergleich lichtempfindlicher Patienten mit chronischer Migräne (CM) und lichtempfindlichen Patienten ohne Kopfschmerzen zur Frage der Inzidenz fehlfunktionierender Zapfen aufgrund eines Irlen-Syndroms in diesen Gruppen.

**Design:** Prospektive Fall-Kontroll-Beobachtungsstudie.

**Patienten:** Rekrutiert wurden drei Studiengruppen: 1. Photophobe Patienten mit chronischer Migräne, 2. Photophobe Patienten ohne Kopfschmerzen, 3. Symptomfreie Kontrollpersonen.

**Methoden:** Evaluierung der Lichtempfindlichkeit als Total Error Score (TES) mit dem Farnsworth-Munsell 100 HueTest und mittels Elektroretinographie.

**Ergebnis:** Etwa 85% der lichtempfindlichen Personen litten an den Symptomen des Irlen Syndrom (IS). Die verwendeten Farbfilter, welche Tageslicht in Richtung Blau oder Grün/Rot verschieben, reduzierten deutlich die photophobischen Beschwerden. Der Nutzen der Filtergläser war bei den lichtempfindlichen Migränepatienten signifikant stärker ( $p < 0.05$  ANOVA).

**Schlussfolgerung:** Das Irlen Syndrom scheint eine vererbare Krankheit zu sein, zurückzuführen auf eine sektorielle Reduktion des Photopigments der Zapfen. Eine hohe Inzidenz des Irlen Syndroms konnte bei den Patienten mit chronischer Migräne nachgewiesen werden, die besonders gut auf die Farbfilter ansprachen. Weitere Studien sollten dies genauer untersuchen.

**Key words:** Lichtempfindlichkeit, chronische Migräne, Irlen Syndrom, Farbfilter, Elektroretinogramm

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