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Incidence of ocular pathologies in Italian children with Down syndrome

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PURPOSE. *This study identifies the incidence of primary ocular pathologies in a population of Italian children with Down syndrome.*
METHODS. *A total of 157 Italian children with Down syndrome, age between 1 month and 18 years, were screened between February 2005 and October 2006. The ophthalmologic evaluation included a global inspection of orbit and bulbus oculi, evaluation of ocular motility and visual acuity, slit lamp biomicroscopy, cycloplegic skiascopy, tonometry, and indirect ophthalmoscopy.*
RESULTS. *The overall incidence of ocular abnormalities was epicanthal fold (132 patients, 84%), hyperopia (93 patients, 59%), astigmatism (44 patients, 28%), myopia (14 patients, 9%), strabismus (56 patients, 36%, 45 cases of esotropia and 11 cases of exotropia), congenital nasolacrimal duct obstruction (35 patients, 22%), cataract (18 patients, 11%), nystagmus (9 patients, 6%), blepharitis and conjunctivitis (6 patients, 4%), and retinal anomalies (10 patients, 6%). Unlike previous reports in patients with Down syndrome, no congenital glaucoma, keratoconus, or Brushfield spots were observed.*
CONCLUSIONS. *Compared to other studies in patients with Down syndrome, we observed a higher incidence of hyperopia and a lower incidence of myopia. The incidence of nystagmus, blepharitis, and conjunctivitis was less than that reported in other studies, while strabismus, especially exotropia (20%), had a high incidence in our cohort. We also frequently observed obstruction of the nasolacrimal duct (22%), but no keratoconus or glaucoma. (Eur J Ophthalmol 2007; 17: 817-22)*

KEY WORDS. *Cataract, Down syndrome, Congenital nasolacrimal duct obstruction, Strabismus*

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INTRODUCTION

Down syndrome (DS) is caused by a chromosomal anomaly and is characterized, among other alterations, by a high rate of ocular abnormalities of the eyelids, cornea, iris, lens, retina, and optic disc, leading to amblyopia, strabismus, nystagmus, and other pathologies (1).
Epidemiologic studies on the incidence of ocular anomalies in children with DS tend to show great variability depending on the population that was examined (2-4). The present study identifies the incidence of ocular anomalies in 157 Italian children with DS.

METHODS

Patients (n=157) were screened for ocular abnormalities at the Paediatric Ophthalmology and Ocular Genetics Division of the Department of Ophthalmologic Sciences of the University Federico II in Napoli, Italy. The patients came from a regional non-profit Down Syndrome Association in Campania.
Seventy of 157 patients were boys, 87 were girls. At the time of ocular examination, the age distribution was as follows: 81 children were under 3 years of age, 26 were between 4 and 6 years of age, 16 were between 7 and 9 years of age, and 34 were between 9

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and 18 years of age. The mean age of the children was 5.28 years (range: 1 month to 18 years), while the mean age of their mothers at conception was 31.8 years. Sixty-one children (39%) were born preterm.

The family history showed a genetic predisposition for DS in 3 patients (1.9%). Karyotype analysis gave the following results: trisomy 21 in 153 patients (97.4%), Robertsonian translocation (14:21) in 1 patient (0.6%), and mosaicism in 2 patients (1.2%).

All children underwent an initial ocular assessment: after a global inspection of the orbita and bulbus oculi, intrinsic and extrinsic ocular motility was assessed using the alternate cover-uncover test. Excursions and visual fixation were identified by testing horizontal and vertical non-concomitance. In addition, head position anomalies, eyelid conformation, and the amplitude of the palpebral fissure were evaluated. Visual acuity was measured with a dynamic visual acuity test using the optotype with Albini's E in cooperative children over 3 years of age. In non-cooperating patients, visual acuity was assessed using the behavioral method "Preferential staring direction with forced choice," with a technical variation known as the acuity card procedure (ACP) (5).

Slit lamp biomicroscopy was performed to evaluate the limbus palpebralis, conjunctivae, and any anomalies of the cornea, iris, and lens. Cycloplegic refraction was performed in all patients after instillation of 1% cyclopentolate (three drops in both eyes every 15 minutes).

Emmetropia was defined as a refractive error between –0.75 D and +0.75 D. Myopia was defined as less than –0.75 D, while hyperopia was defined as more than +0.75 D. Astigmatism was defined as an error of more than 0.75 D of cylinder. Anisometropia was defined in patients who presented a difference between the two eyes of more than 1 D. Since glaucoma was a common finding in previous reports, intraocular pressure was measured in some patients. Indirect ophthalmoscopy was performed in all patients to assess the status of the retina, choroidal membrane, and optic disc.

RESULTS

The overall incidence of ocular anomalies in our cohort of 157 children with DS was 100% (157/157). Detailed results are summarized in Table I.

Most children with DS failed the refractive error test (151 patients, 96%): hyperopia was found in 93 patients (59%), myopia in 14 (9%), and astigmatism in 44 (28%). Of these astigmatic patients, 27 had hypermetropic astigmatism and 14 a myopic type (Tab. II).

In 132 patients (84%), ocular phenotypic features typical of DS, such as an epicanthal fold, were found.

Assessment of extrinsic motility demonstrated strabismus in 56 patients (36%), 45 of whom had esotropia, and 11 of whom had exotropia. Two patients presented with hypertropia associated with esotropia, 1 patient with a V-variation associated with exotropia, and 3 patients with hyperfunction of the inferior oblique muscle, one associated with exotropia and one with esotropia.

Nystagmus was observed in 9 patients (6%).

Obstruction of the lacrimal duct was present in 35 patients (22%). Its diagnosis was based on a history of epiphora or recurrent mucopurulent discharge since infancy and by the reflux of mucus when pressure was exerted on the lacrimal sac.

TABLE I - OCULAR ABNORMALITIES IN 157 CHILDREN (1 month to 18 years of age) WITH DOWN SYNDROME LIVING IN THE GREATER NAPLES AREA IN ITALY

Ocular abnormalities	No. of patients	%
Epicanthus	132	84
Hyperopia	93	59
Astigmatism	44	28
Myopia	14	9
Strabismus	56	36
Nasolacrimal duct obstruction	35	22
Lens opacities	18	11
Nystagmus	9	6
Blepharoconjunctivitis	6	4
Telecanthus	27	17
Amblyopia	4	3
Hypertelorism	3	2
Microphthalmos	2	1
Chalazion	1	0.6
Microcornea	1	0.6
Myopic chorioretinitis	5	3
Tapetoretinal degeneration	1	0.6
Pallor of optic nerve	1	0.6
Vessel tortuosity	1	0.6
Preretinal hemorrhage	1	0.6
Tilted disc	1	0.6

Lens opacity was diagnosed in 18 patients (11%), and blepharitis and conjunctivitis in 6 patients (4%). Telecanthus was diagnosed in 27 patients (17%), amblyopia in 4 patients, hypertelorism in 3 patients, microphthalmos in 2 patients, and microcornea and chalazion of the upper lid were each present in 1 case.

Ophthalmoscopy demonstrated the following abnormalities: myopic chorioretinitis (4 cases), myopic chorioretinitis with staphyloma left > right eye (1 case), light temporal pallor of optic nerve (1 patient), vessel tortuosity (1 patient), pigmented tapetoretinal degeneration on the posterior pole (1 patient), light preretinal suprapapillary hemorrhaging (1 patient), and a tilted disc (1 patient).

TABLE II - REFRACTIVE STATUS OF 157 CHILDREN (1 month to 18 years of age) WITH DOWN SYNDROME LIVING IN THE GREATER NAPLES AREA IN ITALY

Refractive errors	Number/total number of children tested (%)
Total astigmatism, diopters	44/157 (28)
1–3	41/44
>3	3/44
Myopia, diopters	14/157 (9)
1–3	6/14
3.25–5	5/14
>5	3/14
Hyperopia, diopters	93/157 (59)
1–3	55/93
3.25–5	31/93
>5	7/93

DISCUSSION

This study identified the many different ocular abnormalities found in a juvenile population of patients with DS. The overall incidence of ocular abnormalities in this population of Italian children with DS was 100% (Table III).

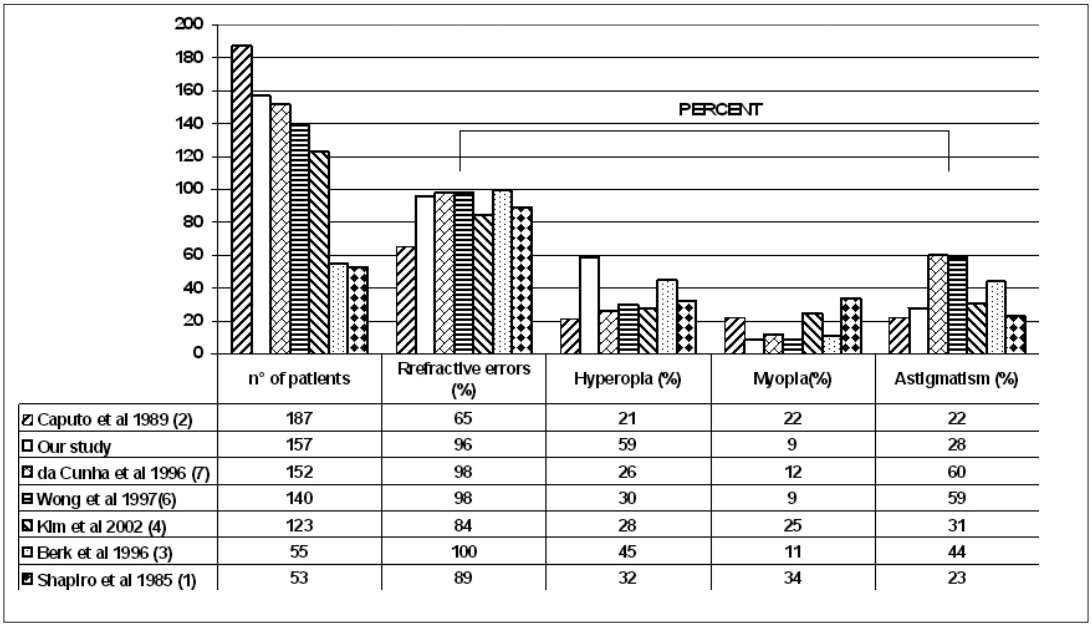
Our cohort showed a high incidence of refractive errors (96%), similar to that reported in Hong Kong (98%) (5) and Brazil (98%) (6) (Fig. 1). However, in our children, the incidence of hyperopia was the highest of all reported (59%). Turkey had the next highest incidence (48%), while all other regions reported a lower incidence (1, 2, 4, 6, 7). One possible explanation was the lower mean age of our population, at 5.28 years; however, the study from China reported an even lower mean age of 3.74 years (6). Age is also a possible explanation for why the incidence of myopia was lower in our group, at 9%, compared to previous studies; however, it was comparable to that found by Berk et al (12%) and Wong and Ho (8%) (3, 6). Astigmatism (28%) had an incidence similar to that reported in the Chinese study (30%) (5), both of which were within the reported range of 22% to 60%.

The incidence of strabismus was 36%, again similar to what Wong and Ho reported (38%) (6) (Fig. 2). Of all strabismus cases, 20% of the children presented with exotropia. While this was similar to the study by Hiles et al (19%) (8), it was much higher than the incidences reported in all other studies, except that performed in Korea (42%) (Tab. IV). Nystagmus was found in 6% of the examined children, similar to that reported by Eissler and Longenecker (4%) (9), but lower than the other studies reported in Figure 2.

The incidence of lens opacities (11%) was in accordance with a previous study by Caputo et al (11%) (2)

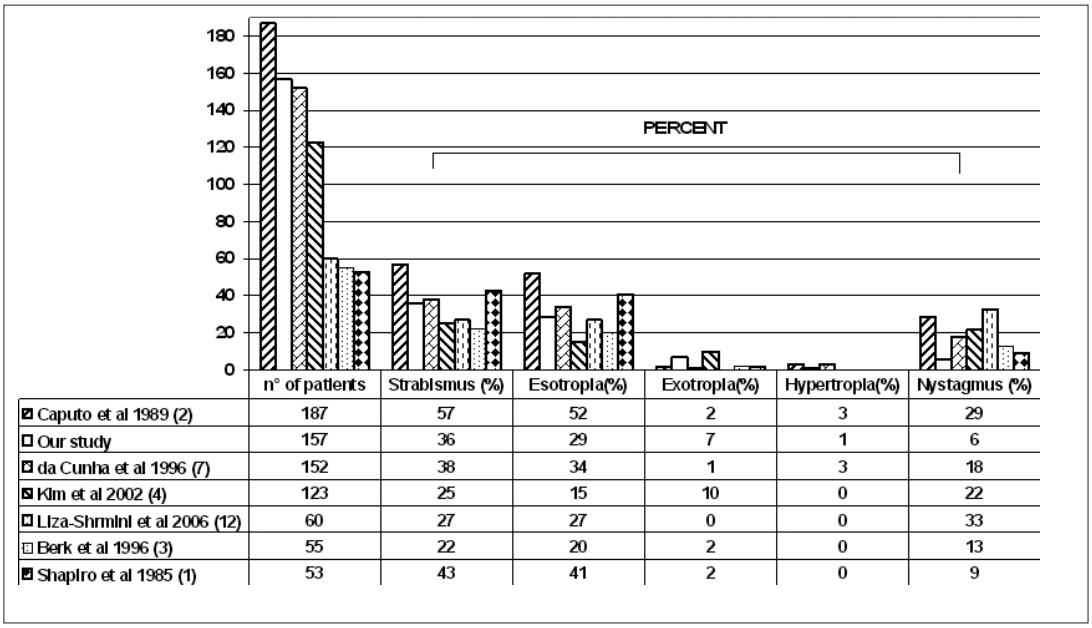
TABLE III - COMPILATION OF EPIDEMIOLOGICASTUDIES THAT HAVE IDENTIFIED THE INCIDENCE OF OCULAR ABNORMALITIES IN JUVENILE DOWN SYNDROME POPULATIONS

	Present study	Liza-Sharmini et al (12)	Kim et al (4)	Wong and Ho (6)	da Cunha et al (7)	Berk et al (3)	Caputo et al (2)	Shapiro et al (1)
Year	2007	2006	2002	1997	1996	1996	1989	1985
No. of patients	157	60	123	140	152	55	187	53
Nationality	Italy	Malaysia	Korea	Hong Kong	Brazil	Turkey	US	US
Age range, yr	0–18	0–17	0–14	0–13	0–18	0–25	0–26	7–36
Mean age, yr	5.28	6.72	6.5	3.74	–	7.2	5.8	17.4



	n° of patients	Rrefractive errors (%)	Hyperopia (%)	Myopia(%)	Astigmatism (%)
Caputo et al 1989 (2)	187	65	21	22	22
Our study	157	96	59	9	28
da Cunha et al 1996 (7)	152	98	26	12	60
Wong et al 1997(6)	140	98	30	9	59
Kim et al 2002 (4)	123	84	28	25	31
Berk et al 1996 (3)	55	100	45	11	44
Shapiro et al 1985 (1)	53	89	32	34	23

Fig. 1 - *Comparison of refractive errors to other studies.*



	n° of patients	Strabismus (%)	Esotropia(%)	Exotropia(%)	Hypertropia(%)	Nystagmus (%)
Caputo et al 1989 (2)	187	57	52	2	3	29
Our study	157	36	29	7	1	6
da Cunha et al 1996 (7)	152	38	34	1	3	18
Kim et al 2002 (4)	123	25	15	10	0	22
Liza-Shrmini et al 2006 (12)	60	27	27	0	0	33
Berk et al 1996 (3)	55	22	20	2	0	13
Shapiro et al 1985 (1)	53	43	41	2	0	9

Fig. 2 - *Comparison of ocular motility anomalies to others studies.*

(Fig. 3). Fourteen opacities were bilateral, while 4 were monolateral, for a total of 32 eyes. The types of opacities are reported in Table V. Congenital cataract was diagnosed in 2 patients who had previously undergone surgery.

The incidence of nasolacrimal duct obstruction (22%) was similar to the Turkish study (22%), while results reported in other studies ranged from 5 to 30% (Fig. 3). Blepharitis and conjunctivitis were present in 4% of the examined children, an incidence comparable to that reported in the study of Wong and Ho (7%), but lower than the values reported in other studies (Fig. 3).

The incidence of keratoconus in children with DS has been reported to be between 0% and 30%, therefore it was not surprising that it was absent in our patients.

Epicanthal fold was diagnosed in 84%, a finding in line with other studies that reported a range between 9% and 100% (10-13) (Fig. 3). Unlike other series, our DS group exhibited no glaucoma or Brushfield spots.

In summary, Italian children with DS exhibited a higher

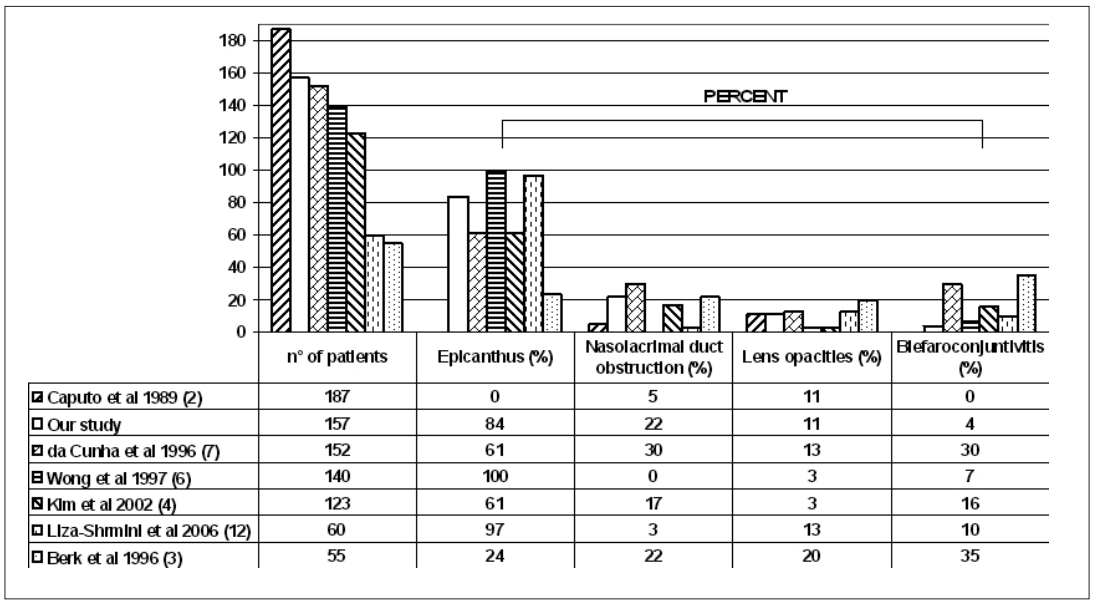


Fig. 3 - *Comparison of ocular anomal to other studies.*

TABLE IV - COMPARISON OF INCIDENCE OF STRABISMUS AND EXOTROPIA IN PRESENT AND PREVIOUS EPIDEMIOLOGIC STUDIES OF CHILDREN WITH DOWN SYNDROME

Study (reference)	Incidence of strabismus, n (%)	Esotropia: exotropia: hyperopia	Incidence of exotropia within the subgroup of children with strabismus, %
Present study	56/157 (36)	45:11:2	20
Liza-Sharmini et al (12)	16/60 (27)	16:0:0	0
Kim et al (4)	31/123 (25)	18:13:0	42
Wong and Ho (6)	28/140 (20)	—	—
da Cunha et al (7)	57/152 (38)	51:2:4	3.5
Berk et al (3)	12/55 (25)	11:1:0	8.3
Caputo et al (2)	107/187 (57)	97:4:6	1
Shapiro et al (1)	23/53 (43)	22:1:0	3.3
Hiles et al (8)	42/123 (34)	34:8:0	19
Lowe (10)	22/67 (33)	22:0:0	0

TABLE V - INCIDENCE AND TYPE OF LENS OPACITY IN 18/157 ITALIAN CHILDREN WITH DOWN SYNDROME

Number of eyes	Type of opacity	Percent of total affected eyes (N=32)
10	Zonular	31
10	Pulverulent	31
7	Posterior polar	22
4	Total	13
1	Anterior polar	3

rate of hyperopia and a lower rate of myopia compared to previously reported epidemiologic studies. The incidences of nystagmus, blepharitis, and conjunctivitis were lower than previously reported. Findings for strabismus were outside the norm, since 20% of our cohort presented with exotropia. Another significant finding was the relatively high incidence of nasolacrimal duct obstruction, found in 22% of the patients. There were no keratoconus or glaucoma cases in our children.

Proprietary interest: None.

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