Congenital Pupillary–Iris–Lens Membrane With Goniodysgenesis: Clinical History and Ultrabimicroscopic Findings

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INTRODUCTION

Congenital pupillary–iris–lens membrane with goniodysgenesis was described by Cibis et al.¹ as a new entity in 1986. They described two patients with an abnormal chamber angle and unilateral prominent Schwalbe’s line, into which a vascularized pupil–iris–lens membrane was inserted. They believed these cases formed a new entity distinct from Rieger’s anomaly, goniodysgenesis, and persistent pupillary membrane.

We examined a 4-month-old patient with congenital pupillary–iris–lens membrane with goniodysgenesis using high-frequency (50-MHz) ultrasonography. We report additional abnormalities of the ciliary processes, posterior chamber, and lens. Our patient was observed for 16 months. He developed a flat anterior chamber, pupillary block, and retinal detachment. Surgical iridectomy was performed.

CASE REPORT

A healthy 4-month-old boy was examined because of an abnormal pupil in the right eye. He had no family history of pupil abnormalities or glaucoma. He was born after a normal gestation by spontaneous labor. There was no history of intrauterine infection. Amniocentesis had not been performed. He had no other abnormalities such as facial, dental, or umbilical malformations suggesting Rieger’s anomaly.

A slit-lamp microscopic examination of the right eye showed an irregular small pupil displaced toward the limbus at the 12-o’clock position. The remaining iris stroma appeared stretched without visible furrows or crypts. After the pupil was dilated, we observed an oval pupil with a thick fibrous strand of tissue originating from the peripheral cornea. The fibrous membrane was attached with a large adhesion to the anterior surface of the lens (Figure 1). An examination of the left eye revealed no pathologic changes.

Under general anesthesia, gonioscopy showed

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Biocompatibility and biodegradation of intravitreal hyaluronan implants in rabbits

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Abstract

To study the biocompatibility and the biodegradation rate in vivo of new intravitreal implants made with three different hyaluronic acid esters: Hyaff7, Hyaff11 and Hyaff11p75 (100% ethyl ester, 100 and 75% benzyl esters, respectively), the plugs were implanted through a sclerotomy at 3.5 mm from the limbus of rabbit eyes. In order to evaluate the in vivo biodegradation the shaft diameter of the plugs was measured by ultrasound biomicroscopy, slit lamp microscopy, ophthalmoscopy and ERG were performed periodically. The effects of the implants on ocular tissues were also evaluated histologically. All the plugs showed a good biocompatibility. Plugs of both the total esters, Hyaff7 and Hyaff11, were found to undergo a slow dissolution process for 60 and 150 days, respectively. The partial benzyl ester, Hyaff11p75, was completely resorbed after 15 days. Analysis of variance showed a high correlation between biodegradation rate and the time of resorption (F = 90.5; p < 0.001). The biodegradation rate of each implant is related to the chemical structure of the thre types of Hyaff (F = 4.51; p = 0.005). The present data suggest that intravitreal implants based on hyaluronic acid esters represent useful biocompatible and biodegradable devices for a potential drug delivery system in the treatment of posterior segment ocular diseases. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Hyaluronan esters; Scleral implant; Biocompatibility; Biodegradation; Ultrasound biomicroscopy

1. Introduction

Intravitreal implants, made with different biomaterials, have been recently evaluated as sustained drug-delivery systems. Scleral plugs avoid impair clarity of the ocular media compared to other drug delivery systems such as liposomes or microspheres. The use of a scleral device for treating cytomegalovirus retinitis (CMV) was reported by Sanborn et al. [1]. The device was not biodegradable, therefore repeated implantations or a surgical procedure for its removal were required. Recently, scleral plugs of biodegradable polymers for controlled drug delivery in the vitreous have been investigated for the treatment of proliferative retinopathy [2,3]. CMV retinitis [4] and fungal endophthalmitis [5]. Polymers such as polylactic acid) at different molecular weights [6], poly(lactic-glycolic acid) [7], and polyvinyl alcohol [2] have been used to make intravitreal implants. We investigated new scleral implants made with different esters of hyaluronic acid in the rabbit eye. Hyaluronan is a common component of the extracellular matrix composed of repeating N-glucuronic acid and N-acetyl-D-glucosamine monomers. Hyaluronan has been widely used in medical practice in different pathological conditions such as eye surgery, osteoarthritis and wound repair. The aim of this study was to evaluate, for the first time the ocular biocompatibility and biodegradation rate in vivo of the new intravitreal implants based on hyaluronan derivatives.

2. Materials and methods

2.1. Preparation of the plugs

Different hyaluronic acid esters obtained from Fidia (Abano Terme, Italy) were prepared by the esterification
Corneal Oedemas: Diagnosis and Surgical Planning with Ultrasound Biomicroscopy

Key Words
Ultrasound biomicroscopy
Echography
Corneal oedema
Osteo-odonto-keratoprosthesis

Abstract
We used the Humphrey Ultrasound Biomicroscope (UBM System 840 by Zeiss-Humphrey Instruments, San Leandro, Calif., USA) to study various corneal oedemas and leukomas. This UBM system, using a high-resolution probe of 50 MHz, has an axial and lateral resolution of about 50 μm. We analysed 36 eyes divided into two groups: 27 (group A) affected by corneal oedema caused by traumatic-mechanic or phlogistic-toxic lesions, 9 (group B) affected by post-surgery oedema. Thanks to its high-resolution power, we could study their pathogenesis and their clinical evolution and so arrange a suitable therapy and perform an accurate follow-up of these pathologies.

Introduction
Among the diagnostic techniques for the study of the anterior segment, echography has played a secondary role, because of the easiness to reach this part of the eye by other investigations. Ultrasound biomicroscopy (UBM) is the newest technique to study the anterior segment of the eye, using probes with a frequency ranging from 50 to 100 MHz; this provides us with information on transparent as well as opaque media or when assessing the nature of tumours of the iris and the ciliary body or of some eye structures unobtainable by any other technique and comparable only with optical microscopy of fixed histological sections [1].

In this study, UBM was used to investigate corneal oedemas and leukomas and their evolutions. This paper shows that UBM is useful in finding the right surgical approach in this type of eye pathology.

Subjects and methods
We used the commercial version of the ultrasound biomicroscope (UBM System 840 by Zeiss-Humphrey Instruments, San Leandro, Calif., USA). It utilizes a 50-MHz transducer that produces a resolution of approximately 50 μm with a tissue penetration of 4–5 mm. The scanner produces a 5 x 5 mm field with 256 image lines at a scan rate of 8 frames/s.

Informed consent was obtained from all patients before UBM examination, which was carried out with the subject in the supine position after the eye had been anaesthetized with a surface anaesthetic. Then a small plastic cup, filled with a coupling substance (gel or water), was placed over the patient’s open eye. It is important to make sure that there is gel or water in the cylinder containing the crystal. This is confirmed by horizontal emission echoes on the video.

We analysed 36 eyes of 36 patients affected by corneal oedemas or leukomas; these were divided into two groups, A and B. To the first group belonged 27 patients whose corneal oedema was caused either by traumatic-mechanic lesions (abrasions, wounds, foreign bodies etc.) or by phlogistic-toxic ones. In the second group of 9 patients oedema appeared after surgery on the anterior segment of the eye.

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Ultrasound-Biomicroscopic Evaluation of Filtering Blebs after Laser Suture Lysis Trabeculectomy

Abstract

Sometimes in glaucomatous patients treated with trabeculectomy there is no correlation between bleb shape and intra-ocular pressure (IOP). In this study we evaluated the ultrasound biomicroscopy (UBM) features of filtering blebs after laser suture lysis (LSL) trabeculectomy in order to analyse whether its ultrasound-biomicroscopic image can predict the function (IOP). Methods: The Humphrey ultrasound biomicroscope, using a high-frequency (50-MHz) probe, provides high-resolution images of filtering blebs. A total of 103 filtering blebs after LSL trabeculectomy were analysed by UBM. Taking into account the characteristics of internal reflectivity and scleral flap, we classified the blebs into three groups (good, fair, poor) that indicate the bleb function and correlated this UBM pattern with the IOP control (good, borderline, failure). Results: There was a statistically significant correlation between the UBM classification of function and the IOP control level. Both well-functioning and failed trabeculectomies could be identified by UBM. The UBM images of eyes with good IOP control are characterized by better visibility of the route under the scleral flap and a low reflectivity inside the bleb. Conclusions: In accordance with previous studies, we believe that UBM can be a useful method to study and explain the mechanisms of filtering structures and, together with IOP control, to evaluate the bleb function.

Introduction

Trabeculectomy is a landmark of ophthalmology which originated from the intuitions of authors like Cairns, Coryllos, Castelli, Frommopoulous or Della Porta. Its effectiveness as an antiglaucomatous procedure is still lasting after nearly 30 years, even if several technical modifications have been proposed to increase its success rate and to obviate some related complications. To date, the lack of a real standardization of this technique is yet the cause of frequently contradictory reports on success rates and complications in the ophthalmic literature [1-4].

In fact, the success of such a filtering procedure depends on the development of a correct balance between two adverse extremes: on the one hand an insufficient and/or transient pressure control and on the other an overfiltration.

However, there is still a small but significant failure rate. The reason for failure is often unclear; in fact, sometimes there is not an absolute correlation between the appearance of the filtering bleb and the intra-ocular pres-
Keratoconus Staging with Ultrasound Biomicroscopy

Abstract
The diagnosis of keratoconus is based on slit-lamp and keratometric findings, and its classification includes 4 different stages. In this study, we compare the ultrasound biomicroscopy (UBM) findings and the keratoconus index (KI) determined using UBM with the severity of the disease. By means of UBM (Humphrey Instruments system model 840) using a 50-MHz probe, we studied 49 eyes affected with different forms of keratoconus. Using a method previously described, we calculated the KI and compared these data with the findings obtained using videokeratography. The mean thickness at the corneal apex in keratoconic eyes was 0.369 mm, while the mean peripheral corneal thickness was 0.568 mm. The mean KI was 1.449 in keratoconic eyes. The KI increased according to the severity of the disease. The mean central keratometry power was 56.95, while the mean amount of steepening of the inferior cornea compared with that of the superior cornea was 8.16. UBM can be considered a useful tool in the study of keratoconus. Using high-frequency ultrasound, it is also possible to obtain reliable measurements of corneal thickness related to the severity of the disease determined by videokeratography.

Introduction
Keratoconus is a bilateral, progressive, non-inflammatory disorder of the cornea [1]. The majority of cases occur during adolescence between puberty and the first half of the third decade [2]. One of the major events that characterize the disorder is corneal thinning. Although this is a prominent feature of advanced keratoconus, it has been suggested that the cornea is measurably thinner than normal in the majority of cases at an early stage of the disease [3]. It has also been demonstrated that corneal thickness is normal outside the conus [4, 5].

Recently, high-frequency, high-resolution ultrasound biomicroscopy (UBM) has been developed as a new diagnostic tool for imaging the anterior segment structures [6]. Our study was designed to show the UBM features of mild, moderate and severe forms of keratoconus and to determine corneal thickness and the keratoconus index (KI) and to compare these data with the severity of the disease determined using videokeratography.

Patients and Methods
We studied 25 patients (49 eyes) with a diagnosis of bilateral keratoconus (one had already undergone corneal transplantation). The criteria for diagnosis included slit-lamp findings, keratometry and videokeratography. Informed consent was obtained from all patients and they underwent UBM (Ultrasound Biomicroscope System Model 840, Humphrey Instruments) examination using a 50-MHz probe that allows a resolution of 50 μm. This high-frequency, high-resolution system works with a speed of ultrasound of 1.540 m/s.

The technique of measuring corneal thickness and to determine the KI with UBM has previously been described [7].
Rapid Communications

Estimating the Keratoconus Index from Ultrasound Images of the Human Cornea

Filippo Castiglione and Francesco Castiglione

Abstract—The keratoconus index (KI) is a new biometric parameter to make diagnosis and to follow the development of the keratoconus in human eyes. Using images from an ultrasound biomicroscope, we show a semi-automatic method to speed up the computation of the KI.

Index Terms—Cornea, Image analysis, keratoconus, ultrasound biomicroscope.

I. INTRODUCTION

The keratoconus is a corneal dystrophy evidenced by a progressive asymmetric increment of the corneal curvature and corneal thinning [1], [2]. The computerized videokeratography has been suggested to detect earliest modification of the corneal curvature [3], [4]. Other methods rely on the fact that the cornea is measurably thinner in majority of cases at an early stage of the disease, and is normal outside the cone [5]–[7]. The difference between central and peripheral corneal thickness has been exploited in ultrasound pachymetry as a diagnostic criterion for keratoconus [8]. Recently, ultrasound biomicroscope (UBM) was developed as a new diagnostic tool. In particular, it has been suggested that this method is accurate and reproducible for determining corneal thickness in clinical practice [9], [10].

The UBM equipment is commonly used to study the anterior segment of the eye (cornea, anterior chamber, iris, iridocorneal angle, lens, posterior chamber, zonulae, iridociliaris angle, ciliary processes, pars plana retinae), and its pathologies such as various form of glaucoma, tumors, inflammation, and trauma.

The study in [11] and [12] showed the utility of the UBM to estimate corneal thickness both in patients affected with early stages of keratoconus and in normal subjects. The keratoconus index KI was developed as reliable assessment of the corneal thinning. The original procedure to compute the KI (defined in the next section) is based on measures taken by the operator using the ultrasound biomicroscope.

In the present paper, we propose a new semi-automatic procedure to compute the KI from the ultrasound images, and thus, reducing the errors in the manual measurements. We then achieve a twofold goal: speed up the evaluation of the KI and reduce human intervention.

II. DATA AND METHODS

The KI was defined as the ratio between the peripheral corneal thickness and the central corneal thickness [11], [12]. In fact, while in keratoconic eyes the central thickness is reduced meaningfully, the peripheral thickness is unaffected by the dystrophy [5], [6], [8]. Therefore, if we call TCT the thinnest corneal thickness located in the central region of the cornea, and PCT the peripheral corneal thickness in the peripheral region of the cornea, we can define the keratoconus index as the ratio KI = PCT/TCT. Fig. 1 shows a stylized eye and a scan line of the UBM position to take the image. The scan line can be displaced in the inferior meridian as well as in the superior, nasal, or temporal meridian. In [11], all four images were used to compute a better statistical value of the KI for each of the patient’s eye.

To estimate the KI using the UBM one must 1) take the ultrasound image; 2) localize and compute both the TCT and PCT just by visual inspection; and 3) compute the ratio. The procedure consists of the following steps:

1) the operator chooses, according to visual inspection, the point of the cornea with reduced thickness (apex of the cone) where to take the ultrasound biomicroscope image (see Fig. 2);
2) computes the thickness of the cornea at that point (TCT) using the cursor-based facilities (segment caliper) supplied with the equipment;
3) computes the peripheral thickness (PCT) at 2.5 mm from the thinnest site of the cone (i.e., in the noncentral region of the cornea);
4) computes the ratio KI.

The drawbacks of a fully manual execution of the measurements is a rather poor objective calculation of the index. To alleviate such problem we decided to automate the procedure from steps 2)–4).

We used images taken by means of a commercial version of the Ultrasound Biomicroscope1 equipped with a 50-MHz probe that allows a resolution of 50 μm. The images come directly from the equipment in PCX graphics format. Each image is 256 × 256 pixels large, in 256 gray levels. The scale factor is 1 mm = 5.12 pixels, so that every image represents a square of 5 mm/side of the cornea (see Fig. 2).

Because our method relies on the quality of the images taken by the operator it is worth pointing out that characterizes a good image. Step 1 consists of a) selecting the corneal apex and b) keeping the probe perpendicular to it (as well as possible). The resulting images can vary according to luminosity, contrast and other parameters. As a consequence, we have to consider the images as patterns produced by a noisy...
Keratoconus Staging
A Computer-Assisted Ultrabiomicroscopic Method Compared With Videokeratographic Analysis

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Manuela Pulvirenti, MD,* Benedetto Torrisi,† Filippo Castiglione, PhD,‡ and Alfredo Reibaldi, MD* 

Purpose: The aim of this study was to introduce a new paradigm for keratoconus assessment, the keratoconus index (KI), generated from the ratio of peripheral corneal thickness (PCT) to the thinnest corneal thickness (TCT), and calculated by a computer-assisted procedure after ultrabiomicroscopy (UBM) examination. Then we compared KI and the keratoconus severity index (KSI), obtained by videokeratography in patients with different stages of keratoconus.

Methods: We studied 60 eyes with different forms of keratoconus using the TMS-3 autotopographer and the keratoconus screening program (using Smoak-Klyce methods) and the commercial version of ultrasonic biomicroscope (Paradigm UBM Plus Model P43) equipped with a 50-MHz probe, which was provided with our computer-assisted program. The proportion test Z and the correlation coefficient R were applied to the outcomes.

Results: The keratoconus severity index, KSI, obtained by color-coded videokeratographic maps, was in the range 95% to 32% (mean 52.2%). By means of UBM examination, we obtained 60 images and found values of TCT 0.278–0.592 mm and PCT 0.475–0.704 mm. Applying the computer-assisted method, we obtained values for KI of 1.112–2.159 (mean 1.428).

Conclusions: KI is correlated as well as KSI with the severity of the keratoconus (R = 0.76, P < 0.0001). It can be used as a similar parameter to measure the evolution of the disease, on the basis of corneal thickness rather than the curvature.

Key Words: keratoconus, ultrasound biomicroscopy, videokeratography, computer-assisted diagnosis

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Keratoconus is a corneal noninflammatory disease characterized by a cone-shaped protrusion of the corneal surface (ectasia),1 progressive increase in the corneal curvature with consequent corneal thinning in the region of the cone apex, irregular corneal astigmatism, and other clinical signs and symptoms generated from structural and biochemical changes in the cornea.2–6

It is a bilateral but asymmetric disorder that occurs in most cases during adolescence, between puberty and the first half of the third decade.

The pathogenesis, the biochemical processes, and the etiologic causes are not well known.2–7

The diagnosis of the keratoconus is based on detection of changes in the corneal curvature and corneal thickness, which has been shown to be measurably thinner than normal, in the majority of the cases, from an early stage of the disease.8,9 In addition, there is a measurable difference between central and peripheral cornea thickness; indeed, the corneal thickness is normal outside the conus. This difference has been exploited as a criterion for keratoconus.10

In advanced stages, the diagnosis is easily made from slit-lamp and keratometric findings.2,3

At the early stage the disease is detected using computer-assisted videokeratography, which shows the earliest modification of the corneal curvature, in the presence of regular mires with conventional photokeratoscopy.11–23

In the past, ultrasound pachymetry was the only accurate and reliable method of measuring corneal thickness,24,26 but it does not allow location of the thinnest corneal site.

Recently, the ultrasound biomicroscope (UBM) was revealed as a new and useful tool in the study of keratoconus.27,28 In our studies29,30 we showed the utility of UBM in estimating corneal thickness, both in patients affected with early-stage keratoconus and in normal subjects. In the same studies, the method also proved to be very sensitive, detecting values significantly different in healthy subjects and keratoconic patients (Student test, P < 0.001).

The development of the keratoconus index, KI (the ratio between the peripheral corneal thickness, PCT, calculated in the peripheral region of the cornea, and the thinnest corneal
Transconjunctival Sutureless 25-Gauge Versus 20-Gauge Standard Vitrectomy: Correlation Between Corneal Topography and Ultrasound Biomicroscopy Measurements of Sclerotomy Sites

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Purpose: To determine the correlation between corneal shape changes and ultrabioscopic (UBM) findings at the sclerotomy sites in conventional 20-gauge (G) pars plana vitrectomy (PPV) and 25-G transconjunctival sutureless vitrectomy (TSV) and to compare the effectiveness of the 2 surgical methods.

Design: Prospective, comparative, observational case series.

Methods: Sixty consecutive eyes (60 patients) undergoing primary 3-port PPV Thirty eyes (30 patients, group 20-G) were treated with 20-G standard PPV and 30 eyes (30 patients, group 25-G) with 25-G TSV. We compared healing of the sclerotomy sites in the 2 groups. We determined the correlation between corneal shape changes (surgically induced astigmatism) measured by videokeratography and the durations of scleral healing cicatrization by UBM within each group.

Results: UBM examination showed that the 20-G sclerotomy sites took about 8 weeks to heal, measured as complete opsonation, whereas healing of the 25-G TSV sclerotomy was quite rapid, with complete scleral opsonation in about 4 weeks. Corneal topotography analysis showed, during the early postoperative period, a surgically induced steepening of the cornea in both groups (20 G, 3.08 ± 0.56 diopeters and 25 G, 0.805 ± 0.61 diopeters, P < 0.001, Mann–Whitney test), which then decreased gradually, recovering to the preoperative level within 2 months in group 20 G (P > 0.05) and 1 month in group 25 G (P > 0.05). We found a strong statistical correlation between the surgically induced kerometric astigmatism and the mean UBM measures of scleral healing (r = 0.99 for group 20 G and r = 0.97 for group 25 G).

Conclusion: After PPV, astigmatic changes are significant in the early postoperative period, especially in 25-G group; the 25-G TSV system results in faster reduction of surgically induced kerometric astigmatism because of rapid cicatrization of the sclerotomy sites.

Key Words: ultrabioscopic, corneal topography, corneal shape changes, 20-gauge pars plana vitrectomy, 25-gauge transconjunctival sutureless vitrectomy

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Since the introduction of pars plana vitrectomy (PPV) about 30 years ago,1,2 the evolution of vitrectomy instrumentation has been driven in part by the desire for smaller instruments and greater functionality. The attractiveness of a smaller gauge vitrectomy instrument system is based on its ability to minimize surgically induced trauma from sclerotomy sites, allow for self-sealing (sutureless) sclerostomy, improve operative efficiency, and hasten postoperative recovery. Twenty-five-gauge (25-G) transconjunctival sutureless vitrectomy (TSV) decreases operation time, reduces postoperative inflammation, and speeds postoperative recovery.3–7 It has also been hypothesized that sutureless sclerostomy might be associated with less vitreous incarceration than the conventional technique,6 even if the literature is controversial.7–9

Ultrabioscopic (UBM) is useful for studying sclerotomy sites after PPV10–11 and videokeratography shows the corneal postoperative shape changes after PPV12–14.

Our study was designed to investigate the correlation between corneal shape changes and ultrabioscopic findings of conventional 20-G PPV and 25-G TSV and to compare the effectiveness of the 2 surgical methods.

MATERIALS AND METHODS

Patients and Clinical Examination

This study was approved by our institutional review committee. Informed consent was obtained from all patients.

We studied 60 eyes of 60 consecutive patients (39 male and 21 female subjects) who underwent primary PPV between April 2007 and December 2007 at the Ophthalmology Unit of the S. Marta Hospital, Catania University (Table 1).

In all cases, surgery was performed to treat ocular disease for one of the following retinal conditions: idiopathic...
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ULTERIORI ESPERIENZE NELL’UTILIZZO
DELL’OFTALMOSCOPIO A SCANSIONE LASER
NELLA PRATICA CLINICA

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BOLOGNA
VALUTAZIONE DEL CHERATOCONO:
CONFRONTO TRA L’ULTRABIOMICROSCOPIA CON
METODICA SEMI-AUTOMATICA E LA VIDEOTOPOGRAFIA

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RIASSUNTO

SCOPO DEL LAVORO: Scopo del nostro studio è confrontare il Keratoconus Index (KI), un indice di riferimen-
to per lo studio del cheratocono (ottenuto dal rapporto tra lo spessore corneale in un punto periferico (PCT)
e lo spessore nel punto più sottile (TCT)), estrapolato da misure effettuate mediante esame UBM ed elabora-
to con un programma semi-automatico KIPRO (Keratoconus Index Project), con il Keratoconus Severity Index
(KSI), ottenuto applicando il programma Keratoconus Screening Program (metodo di Smolek/Klyce) ad esame
videotopografico.

MATERIALI E METODI: È stato scelto un campione di 40 pazienti per un totale di 50 occhi, con stadi diversi
di cheratocono. Ogni paziente è stato sottoposto ad esame topografico (usando l’autotopografo TMS-3 dotato
del programma di screening per il cheratocono) e ad esame ultrabiomicroscopico UBM (è stato utilizzato il
Paradigm UBM Plus Model P45), associato al programma Kipro.

RISULTATI: Sono state ottenute 50 mappe corneali e i relativi valori del KSI (valore max = 95%, valore min =
48.3%, valore medio = 77.84%). Dall’UBM si sono ottenute 50 immagini, che sono state poi elaborate dal
programma Kipro, che ha calcolato i valori del TCT (0.279 - 0.589 mm), PCT (0.475 - 0.702 mm) e KI (1.127
- 2.159; valore medio = 1.478). Gli indici risultanti sono stati confrontati tra di loro mediante il test del chi-
quadrato.

CONCLUSIONI: KI presenta una correlazione alla gravità della patologia comparabile al KSI, sebbene ottenuto
con metodica diversa ed indipendente dalla topografia e valutando un diverso elemento della patologia.
L’UBM si dimostra un valido ed utile strumento per lo studio del cheratocono.

PAROLE CHIAVE: Cheratocono, ultrabiomicroscopia, topografia, diagnosi computerizzata.

ABSTRACT

COMPARISON BETWEEN COMPUTER-ASSISTED ULTRABIOMICROSCOPIC METHOD AND VIDEO-KERATOGRAPHIC
ANALYSIS IN KERATOCONUS STAGING

PURPOSE: In our study we compared the keratosusus Index (KI), the ratio between peripheral corneal thickness
(PCT) and the thinnest corneal thickness (TCT), obtained by the ultrabiomicroscope exam using a computer-
assisted procedure, and the keratoconus severity index (KSI), obtained by videokeratography using the
Smolek/Klyce method.

METHODS: We studied 40 eyes with different forms of keratoconus. Everyone was subjected to videokerato-
graphy, using the TMS-3 autokeratop, provided with a keratoconus screening program (Smolek/Klyce method)
and to the ultrasound biomicroscope, using the commercial version of UBM (Paradigm UBM Plus Model P45)
equipped with a 50 MHz probe and provided with Kipro program, our computer-assisted program.

RESULTS: We obtained 50 colour-coded videokeratographic maps and we obtained the values of KSI aplly-
ing the keratoconus screening program (Smolek-Klyce method) on each map. The keratoconus severity in-
dex, KSI, was in the range 95% - 48.3% (mean = 77.84%). By means of UBM-examination, we obtained 50
Esami strumentali: l’ecografia

Fin dalla sua introduzione nel 1956, l’ultrasonografia oftalmica si è dimostrata un ausilio diagnostico essenziale nella pratica clinica. In quanto non invasiva e ripetibile, è utile per la valutazione del bulbo oculare e dell’orbita, ed è indispensabile in caso di opacità dei mezzi diottici.

L’ecografia rappresenta un esame complementare da associare all’esame del fundus anche in presenza di mezzi trasparenti per:

1. lo studio preoperatorio di lesioni vitreo-retiniche in quanto consente di stabilire il corretto approccio chirurgico, il timing dell’intervento e il corretto posizionamento degli strumenti,
2. il monitoraggio dell’evoluzione di talune patologie (neoplasie solide),
3. lo studio della retina nel post-operatorio (rappresenta della retina con il materiale indenterante o con i tamponi interni),
4. lo studio della coroide.

Esistono due modalità per eseguire un esame ecografico:
- ecografia A-Scan monodimensionale,
- ecografia B-Scan bidimensionale.

Nel 1956 Mundt e Hughes introdussero in campo oftalmologico l’ecografia A-Scan, modimensionale mediante l’utilizzo di una sonda di 8 MHz, tale tecnica venne poi messa a punto da Oksala nel 1960, ma fu Ossoinig nel 1974, a sviluppare l’A-Scan standardizzato, idoneo a una accurata differenziazione dei tessuti oculari.

Questa tecnica prevede l’utilizzazione di una sonda da 8 MHz con fascio non focalizzato, parallelo con amplificazione del segnale di ritorno detta a S. L’esame va effettuato a valori di amplificazioni stan-
L’ultrabiomicroscopia introdotta da Pavlin nel 1990 come evoluzione delle apparecchiature B-scan, ha rivoluzionato e completato il ruolo dell’ecografia convenzionale in campo oftalmologico per lo studio delle patologie del segmento anteriore e della cornea in particolare.

Fanno parte ormai della storia tecniche indagini quali: l’immersione, il minibagno e l’uso di distanziatori a cui si faceva ricorso per avere una rudimentale immagine della cornea mediante le tradizionali metodiche A e B-scan. Le sonde utilizzate, data la loro bassa frequenza di emissione degli ultrasuoni (8-10 MHz) forniscono infatti, immagini con una risoluzione molto scarsa, così da distinguere nella cornea solo la fascia anteriore da quella posteriore.\textsuperscript{1,2,3,4}

L’A-scan visualizza immagini monodimensionali ed utilizza una piccola sonda da 8 MHz che emette un fascio ultrasonoro non focolizzato: il tracciato che viene visualizzato è rappresentato da un grafico tempo-ampiezza in cui l’altezza dei picchi è proporzionale alla reflittività delle strutture attraversate dal fascio ultrasonoro. La cornea appare come un picco ad alta reflittività, bifido, le cui estremità rappresentano la fascia anteriore e quella posteriore. Le uniche diagnosi possibili sono quindi l’aumento dello spessore o l’individuazione, peraltro molto complessa di piccoli corpi estranei. Il B-scan visualizza invece immagini bidimensionali ed utilizza routinariamente una sonda da 10 MHz che emette un fascio di ultrasuoni focalizzato: la cornea appare come due linee altamente riflettenti tra cui è possibile evidenziare uno spazio anecogeno che rappresenta lo stroma. L’unica utilità clinica è quella di fornire un quadro topografico delle strutture del segmento anteriore e quindi di evidenziare ad esempio sinechie iridoedoteliali o alterazioni grossolane dello stroma corneale.\textsuperscript{2,5}

La biomicroscopia ad ultrasuoni è una tecnica capace di visualizzare le strutture anteriori del bulbo in sezione radiale e trasversa fornendo una risoluzione molto simile a quella della normale microscopia ottica: l’UBM P45 PLUS (PARADIGM medical instruments) è l’apparecchio attualmente in commercio. Esso è fornito di una sonda di 50 MHz e permette la visualizzazione di immagini su video con una risoluzione di 864x432 pixel, con un campo di osservazione di 5x5 mm e 64 livelli di grigi, la velocità degli ultrasuoni è di 1530 m/sec. Il software inserito nella macchina permette di variare la profondità di focalizzazione del fascio ultrasonoro. Esiste la possibilità di usare trasduttori a diversa frequenza per ottenere un migliore rapporto tra penetrazione e risoluzione: per ottenere la miglior visualizzazione delle caratteristiche anatomiche e patologiche della cornea sarebbe necessario ricorrere a