Abstracts

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Use of anterior segment optical coherence tomography to study corneal changes after collagen cross-linking

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Keratoconus is a bilateral, progressive corneal disease with a multifactorial cause and a classical onset at puberty. It is characterized by corneal collagen structure changes, decreased corneal rigidity, and corneal thinning, leading to a progressive corneal deformation (conical protrusion) and decreased vision. Early treatment options are correction of the refractive error by spectacles or contact lenses (such as soft, rigid, or scleral lenses). In contact lens-intolerant patients with mild to moderate keratoconus, the implantation of intracorneal ring segments can be considered because they lead to a flattening effect of the cornea and can increase contact lens tolerance. However, these treatment options do not interfere with the progression of the disease and therefore are insufficient in cases of progressive keratoconus. In advanced cases of keratoconus (eg, with corneal scars, thin, bulging corneas, or both), penetrating or lamellar keratoplasty procedures are the only solution. Until now, keratoconus remains one of the leading indications for keratoplasty. For progressive, nonadvanced cases, corneal collagen cross-linking has become available, leading to a mechanical strengthening of the cornea and thereby achieving a stabilization of the disease. This may delay the need for keratoplasty in this young, nonadvanced patient group.

Corneal cross-linking, which combines riboflavin eye drops and ultraviolet A (UVA) radiation, was first described by Spoerl and associates in 1998. UVA radiation in combination with riboflavin generates reactive oxygen species, leading to the formation of cross-links between the corneal collagen fibers. The primary goal of corneal cross-linking is to increase corneal rigidity by increasing the mechanical stability of the corneal stroma. Wollensak and associates reported a 4.5 times increase in biomechanical rigidity in human corneas after corneal cross-linking, with a primary treatment effect in the anterior 300 μm of the corneal stroma. In current practice, patients with progressive keratoconus or post-laser in situ keratomileusis (LASIK) ectasia may be eligible for corneal cross-linking, provided that their corneas are clear and not too thin.

The purpose of this study was to investigate the stromal demarcation line after corneal cross-linking using anterior segment optical coherence tomography (AS-OCT) and its influence on the short-term results of cross-linking in patients with progressive keratoconus.

Twenty-nine eyes of 29 patients with progressive keratoconus (n=28) or after laser in situ keratomileusis ectasia (n=1) were included and treated with corneal cross-linking at our institution. Measurements at 1, 3, 6, and 12 months after corneal cross-linking were refraction, best-corrected visual acuity (BCVA), tonometry, corneal topography, AS-OCT, specular microscopy, and aberrometry. Demarcation line depth was measured centrally, 2 mm temporally, and 2 mm nasally by two independent observers using AS-OCT and was correlated with clinical parameters.

The stromal demarcation line was visible with AS-OCT at 1 month after surgery in 28 of 29 eyes. Pairwise comparisons between the two observers of the AS-OCT measurements did not show a statistically significant difference. After an initial steepening of maximal keratometry values and a decrease in BCVA at 1 month after surgery (both with $P < .012$), no significant changes were found at 3, 6, and 12 months after surgery compared with before surgery. Refractive cylinder, topographic astigmatism, aberration values, endothelial cell density, and intraocular pressure remained stable during all postoperative visits. A deeper demarcation line depth was associated with a larger decrease in corneal thickness ($r = -0.506$; $P = .012$).

Authors concluded with the remarks that AS-OCT is a useful device to detect the stromal demarcation line after corneal cross-linking. At 3 to 12 months follow-up, all clinical parameters remained stable,

indicating stabilization of the keratoconic disease.

A simple and evolutional approach proven to recanalise the nasolacrimal duct obstruction

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Nasolacrimal duct obstruction (NLDO) and chronic dacryocystitis are common ophthalmic diseases. The external dacryocystorhinostomy (EX-DCR) has been the most effective and standard surgery in treating these conditions since 1904 when it was reported by Toti. However, EX-DCR is an invasive, relatively complex and time-consuming procedure that causes a facial cutaneous scar. Many patients prefer to suffer tearing rather than undergo this surgery. The improvement on DCR has been made recently, such as the endonasal DCR and endocanalicular laser DCR. These approaches were promising but still necessitate bone removal and require costly equipment. These surgical procedures were reported to have less effective results than EX-DCR and involve a marked learning curve. The approach of the EX-DCR and these new procedures is to create a bypass draining system, rather than to restore the obstructed nasolacrimal duct.

Recanalisation of nasolacrimal duct obstruction (RC-NLDO) was an evolutionally developed surgical approach for treating these conditions to restore the native nasolacrimal duct, using a simple instrument, the lacrimal canaliser, which we created in 1994. Since then, this approach has been widely adopted by many ophthalmologists in China for its simplicity, safety, efficacy and minimal invasion. In the present study, we report the long-term follow-up results of RC-NLDO in the clinical treatment for 506 cases of NLDO and chronic dacryocystitis, as well as the histopathological evidence from animal experiments. The relative indication, contraindication, surgical technique, postoperative care, complications, advantages and disadvantages of the RC-NLDO are discussed.

The purpose of this study was to evaluate a new approach of recanalisation of nasolacrimal duct obstruction (RC-NLDO) in the treatment of the nasolacrimal duct obstruction (NLDO) and chronic dacryocystitis.

583 patients with 641 eyes suffering from NLDO and chronic dacryocystitis were enrolled in this study. The RC-NLDO was performed in 506 eyes, with 135 eyes undergoing external dacryocystorhinostomy (EX-DCR) as controls. Patient follow-up for 54 months was evaluated by symptoms, dye disappearance test, lacrimal irrigation and digital subtraction dacryocystogram. The RC-NLDO was also performed in 12 rhesus monkeys for histopathological examination.

The clinical success rates were 93.1% in 506 cases of RC-NLDO and 91.11% in 135 cases of EX-DCR, The success rates for second surgery were achieved in 85.19% on RC-NLDO and 40.0% on EX-DCR. No major intra- or postoperative complications were observed in the RC-NLDO group. The mean operative duration was 12.5 min for RC-NLDO and 40,3 min for EX-DCR ($p<0.001$). A pathological study in rhesus monkeys demonstrated that the RC-NLDO wounded epithetlium in nasolacrimal duct healed completely within 1 month without granulation tissue formation.

Authors concluded with the remarks that the findings demonstrate that the RC-NLDO is a simple and effective approach proven to recanalise the obstructed nasolacrimal duct with a comparable success rate to EX-DCR.

Macular thickness decreases with age in normal eyes: a study on the macular thickness map protocol in the Stratus OCT

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Histological studies of the human retina and optic nerve have shown a decreased density of photoreceptors, ganglion cells, retinal pigmentepi-thelium and optic nerve fibres with age. These findings, however, do not necessarily have to result in retinal thinning, but one would expect some shrinkage of the total retina over time. Non-invasive techniques have made it possible to measure the thickness of retinal structures in vivo. With optical coherence tomography (OCT), both qualitative and quantitative measurements of the retina can be made. A macular mapping technique that has shown a good reproduce-bility is implemented into the OCT 2000 and OCT3 scanners, which are in clinical use today. Observations based on single scan measurements have shown a decrease in retinal and RNFL thickness with age. In a pilot study, Schuman et al reported that the peripapillary retinal nerve fibre layer (RNFL) decreases with age using

OCT I. Poinoosawmy and coworkers also demonstrated a progressive reduction in the nerve fibre layer thickness with age using scanning laser polarimetry (GDx). In an OCT study by Alamouti and Funk, both retinal and RNFL thickness decreased slightly with age. Finally, Kanai and coworkers also found that retinal thickness decreases with age. None of these investigators, however, used the OCT mapping technique. Based on the findings in postmortem and in vivo studies, one would expect a slight thinning of the total retina. Surprisingly, studies on normal retinal thickness with the mapping protocol have so far not shown any significant correlation between retinal thickness and age. Therefore, we wanted to examine the relation between retinal thickness and age with the macular map technique.

Retinal and retinal nerve fibre layer (RNFL) thinning with age have been described in histological studies. In vivo techniques like optical coherence tomography (OCT) have shown thinning of optic nerve RNFL and the retina in specific areas. One would expect thinning of the total macula, but so far, no correlation with the quantitative OCT macular map tool and age has been found.

Sixty-seven healthy individuals underwent three repeated scans in both eyes with the macular thickness map protocol in the Stratus OCT. That protocol divides the macula area into nine ETDRS fields. The RNFL was measured in one specific location close to the optic disc. Correlations between retinal, RNFL thickness, macular volume and age were determined.

Authors found a statistically significant negative relationship between retinal thickness and age for all ETDRS areas, total macular volume and RNFL thickness. Retinal thickness decreased by 0.26-0.46 μm macula volume 0.01 mm and RNFL 0.09 μm per year.

Authors concluded with the remarks that retinal thickness within the area covered by the macular map significantly decreases with age. In the area examined in the papillomacular bundle, 20% of the retinal thinning is due to the RNFL, and 80% is due to thinning of other layers of the retina.

Intravitreal injection of pegaptanib sodium for proliferative diabetic retinopathy

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Diabetic retinopathy (DR) is a major cause of blindness in the Western world. Research into the aetiology of ocular neovascular diseases such as DR has identified a pivotal role for vascular endothelial growth factor (VECE) in promoting both angiogenesis and increased vascular permeability.

Intravitreal injection of VECP induces many of the pathological changes characteristic of DR, including intraretinal and preretinal neovascularisation, microaneurysm formation, intraretinal haemorrhage, macular oedema and areas of capillary non-perfusion with endothelial cell hyperplasia. Elevated intraocular levels of VEGF have been reported in patients with DR. Moreover, this elevation is more pronounced in PDR than in non-proliferative diabetic retinopathy (NPDR).

The Isoform165 of VECF-A ($VECF_{165}$) is particularly potent in promoting ocular neovascularisation and breakdown of the blood-retinal barrier (BRB) through a leucocyte-dependent mechanism. Pegaptanib sodium is a selective anti-VECF aptamer that binds to VECE. Preclinical studies demonstrated that intravi-treal injections of pegaptanib (IVP) can inhibit pathological ocular neovascularisation while leaving physiological vascularisation unimpaired. In a recent Phase II study of pegaptanib for the treatment of diabetic macular oedema (DME), findings suggested that IVP may be capable of halting and even reversing pathological retinal neovascularisation (NV).

Authors hypothesised that in patients with active PDR, IVP would cause marked reduction in vitreous levels of $VECF_{165}$ with regression or pathological NV, thereby hindering the progression of PDR.

The purpose of this study was to compare the efficacy of intravitreal pegaptanib (IVP) with panretinal laser photocoagulation (PRP) in the treatment of active proliferative diabetic retinopathy (PDR).

A prospective, randomised, controlled, open-label, exploratory study. Twenty subjects with active PDR were randomly assigned at a 1:1 ratio to receive treatment in one eye either with IVP (0.3 mg) every 6 weeks for 30 weeks or with PRP laser. Efficacy endpoints included regression of retinal neovascularisation (IW), changes from baseline in best-corrected visual acuity (BCVA) and foveal thickness. Safety outcomes included observed and reported adverse events.

In 90% of randomised eyes to IVP, retinal NV showed regression by week 3. By week 12, all IVP eyes were completely regressed and maintained through

week 36. In the PRP-treated group, at week 36, two eyes demonstrated complete regression, two showed partial regression, and four showed persistent active PDR. The mean change in BCVA at 36 weeks was +5.8 letters in pegaptanib-treated eyes and -6.0 letters in PRP-treated eyes. Only mild to moderate transient ocular adverse events were reported with pegaptanib.

Authors concluded with the remarks that IVP produces short-term marked and rapid regression of diabetic retinal NV. Regression of NV was maintained throughout the study and at the final visit.