Bibliographie

47.1. Stabilisation – *Cross-linking* cornéen

[1] Zhang Y, Conrad AH, Conrad GW. Effects of ultraviolet-A and riboflavin on the interaction of collagen and proteoglycans during corneal cross-linking. J Biol Chem 2011;286(15):13011–22.
[2] Wollensak G, Spoerl E, Seiler T. Riboflavin/ultraviolet-a-induced collagen crosslinking for the treatment of keratoconus. Am J Ophthalmol 2003;135(5):620–7.
[3] Wollensak G, Spoerl E, Seiler T. Stress-strain measurements of human and porcine corneas after riboflavin-ultraviolet-A-induced cross-linking. J Cataract Refract Surg 2003;29(9):1780–5.
[4] Doors M, Tahzib NG, Eggink FA, et al. Use of anterior segment optical coherence tomography to study corneal changes after collagen cross-linking. Am J Ophthalmol 2009;148(6):844–51.
[5] Seiler TG, Batista A, Frueh BE, Koenig K. Riboflavin concentrations at the endothelium during corneal cross-linking in humans. Invest Ophthalmol Vis Sci 2019;60(6):2140–5.
[6] Abrishamchi R, Abdshahzadeh H, Hillen M, et al. High-fluence accelerated epithelium-off corneal cross-linking protocol provides Dresden protocol-like corneal strengthening. Transl Vis Sci Technol 2021;10(5):10.
[7] Gomes JA, Tan D, Rapuano CJ, et al. Group of Panelists for the Global Delphi Panel of Keratoconus and Ectatic Diseases. Global consensus on keratoconus and ectatic diseases. Cornea 2015;34(4):359–69.
[8] Belin MW, Meyer JJ, Duncan JK, et al. Assessing progression of keratoconus and cross-linking efficacy : the Belin ABCD Progression Display. Int J Kerat Ect Cor Dis 2017;6(1):1–10.
[9] Raiskup F, Theuring A, Pillunat LE, Spoerl E. Corneal collagen crosslinking with riboflavin and ultraviolet-A light in progressive keratoconus : ten-year results. J Cataract Refract Surg 2015;41(1):41–6.
[10] Bordais J, Cassagne M, Touboul D, et al. Conventional epithelial-off corneal cross-linking in patients with progressive keratoconus : 10-year outcomes. Cornea 2024;43(7):874–82.
[11] Sharif R, Fowler B, Karamichos D. Collagen cross-linking impact on keratoconus extracellular matrix. PloS One 2018;13(7), e0200704.
[12] Bouheraoua N, Jouve L, El Sanharawi M, et al. Optical coherence tomography and confocal microscopy following three different protocols of corneal collagen-crosslinking in keratoconus. Invest Ophthalmol Vis Sci 2014;55(11):7601–9.
[13] Richoz O, Tabibian D, Hammer A, et al. The effect of standard and high-fluence corneal cross-linking (CXL) on cornea and limbus. Invest Ophthalmol Vis Sci 2014;55(9):5783–7.
[14] Hammer A, Richoz O, Arba Mosquera S, et al. Corneal biomechanical properties at different corneal cross-linking (CXL) irradiances. Invest Ophthalmol Vis Sci 2014;55(5):2881–4.
[15] Seiler TG, Komninou MA, Nambiar MH, et al. Oxygen kinetics during corneal cross-linking with and without supplementary oxygen. Am J Ophthalmol 2021;223:368–76.
[16] Hafezi F, Kling S, Gilardoni F, et al. Individualized corneal cross-linking with riboflavin and UV-A in ultrathin corneas : the Sub400 Protocol. Am J Ophthalmol 2021;224:133–42.
[17] Mazzotta C, Traversi C, Baiocchi S, et al. Corneal collagen cross-linking with riboflavin and ultraviolet A light for pediatric keratoconus : ten-year results. Cornea 2018;37(5):560–6.
[18] Matthys A, Cassagne M, Galiacy SD, et al. Transepithelial corneal cross-linking with supplemental oxygen in keratoconus : 1-year clinical results. J Refract Surg 2021;37(1):42–8.
[19] Cassagne M, Pierné K, Galiacy SD, et al. Customized topography-guided corneal collagen cross-linking for keratoconus. J Refract Surg 2017;33(5):290–7.
[20] Moraes RLB, Ghanem RC, Ghanem VC, Santhiago MR. Haze and visual acuity loss after sequential photorefractive keratectomy and corneal cross-linking for keratoconus. J Refract Surg 2019;35:109–14.
[21] Kanellopoulos AJ. Ten-year outcomes of progressive keratoconus management with the Athens Protocol (topography-guided partial-refraction PRK combined with CXL). J Refract Surg 2019;35(8):478–83.
[22] Kundu G, Khamar P, Modak D, et al. Simultaneous topography-guided custom ablation with corneal cross-linking for keratoconus : 10-year prospective outcomes. J Refract Surg 2023;39(11):759–66.
[23] Awwad ST, Chacra LM, Helwe C, et al. Mitomycin C application after corneal cross-linking for keratoconus increases stromal haze. J Refract Surg 2021;37(2):83–90.

Greffe de couche de Bowman

[24] Spadea L, Di Genova L, Trovato Battagliola E, Scordari S. Descemetic deep anterior lamellar keratoplasty versus penetrating keratoplasty in advanced keratoconus : comparison of visual and refractive outcomes. Ther Clin Risk Manag 2024;20:127–38.
[25] Borderie VM, Georgeon C, Sandali O, Bouheraoua N. Long-term outcomes of deep anterior lamellar versus penetrating keratoplasty for keratoconus. Br J Ophthalmol 2023;108(1):10–6.
[26] MacIntyre R, Chow SP, Chan E, Poon A. Long-term outcomes of deep anterior lamellar keratoplasty versus penetrating keratoplasty in Australian keratoconus patients. Cornea 2014;33(1):6–9.
[27] Ong ZZ, Wong TL, Suresh L, et al. A 7-year review of clinical characteristics, predisposing factors and outcomes of post-keratoplasty infectious keratitis : the Nottingham infectious keratitis study. Front Cell Infect Microbiol 2023;13:1250599.
[28] Yildiz EH, Erdurmus M, Hammersmith KM, et al. Comparative study of graft rejection in keratoconus patients with and without self-reported atopy. Cornea 2009;28(8):846–50.
[29] Dienes L, Kiss HJ, Perenyi K, et al. Corneal sensitivity and dry eye symptoms in patients with keratoconus. PLoS One 2015;10(10), e0141621.
[30] Claesson M, Armitage WJ. Clinical outcome of repeat penetrating keratoplasty. Cornea 2013;32(7):1026–30.
[31] Deshmukh R, Ong ZZ, Rampat R, et al. Management of keratoconus : an updated review. Front Med (Lausanne) 2023;10:1212314.
[32] Hafezi F. Limitation of collagen cross-linking with hypoosmolar riboflavin solution : failure in an extremely thin cornea. Cornea 2011;30(8):917–9.
[33] Wu H, Luo S, Dong N, et al. The clinical study of corneal cross-linking with hypo-osmolar riboflavin solution in thin keratoconic corneas. Zhonghua Yan Ke Za Zhi 2014;50(9):681–6.
[34] Raiskup F, Spoerl E. Corneal cross-linking with hypo-osmolar riboflavin solution in thin keratoconic corneas. Am J Ophthalmol 2011;152(1):28–32 e21.
[35] Koller T, Mrochen M, Seiler T. Complication and failure rates after corneal crosslinking. J Cataract Refract Surg 2009;35(8):1358–62.
[36] Moghadam RS, Akbari M, Alizadeh Y, et al. The outcome of corneal collagen cross-linking in patients with advanced progressive keratoconus : a 2-year follow-up study. Middle East Afr J Ophthalmol 2019;26(1):11–6.
[37] Ivarsen A, Hjortdal J. Collagen cross-linking for advanced progressive keratoconus. Cornea 2013;32(7):903–6.
[38] Medical Advisory S. Intrastromal corneal ring implants for corneal thinning disorders : an evidence-based analysis. Ont Health Technol Assess Ser 2009;9(1):1–90.
[39] van Dijk K, Parker J, Tong CM, et al. Midstromal isolated Bowman layer graft for reduction of advanced keratoconus : a technique to postpone penetrating or deep anterior lamellar keratoplasty. JAMA Ophthalmol 2014;132(4):495–501.
[40] Espana EM, Birk DE. Composition, structure and function of the corneal stroma. Exp Eye Res 2020;198, 108137.
[41] Wilson SE. The cornea : no difference in the wound healing response to injury related to whether, or not, there's a Bowman's layer. Biomolecules 2023;13(5).
[42] Rigi M, Son HS, Moon L, et al. Collagen type XII is undetectable in keratoconus Bowman's layer. Br J Ophthalmol 2024;108(3):343–8.
[43] Wilson SE. Bowman's layer in the cornea- structure and function and regeneration. Exp Eye Res 2020;195, 108033.
[44] Wilson SE, Hong JW. Bowman's layer structure and function : critical or dispensable to corneal function ? A hypothesis Cornea 2000;19(4):417–20.
[45] Cheng EL, Maruyama I, SundarRaj N, et al. Expression of type XII collagen and hemidesmosome-associated proteins in keratoconus corneas. Curr Eye Res 2001;22(5):333–40.

[46] van Dijk K, Parker JS, Baydoun L, et al. Bowman layer transplantation : 5-year results. Graefes Arch Clin Exp Ophthalmol 2018;256(6):1151–8.
[47] van der Star L, van Dijk K, Vasiliauskaite I, et al. Long-term outcomes of Bowman layer inlay transplantation for the treatment of progressive keratoconus. Cornea 2022;41(9):1150–7.
[48] van der Star L, Vasiliauskaite I, Oellerich S, et al. Bowman layer onlay grafting as a minimally invasive treatment for the most challenging cases in keratoconus. Am J Ophthalmol 2024;261:54–65.
[49] Dapena I, van der Star L, Groeneveld-van Beek EA, et al. Bowman layer onlay grafting : proof-of-concept of a new technique to flatten corneal curvature and reduce progression in keratoconus. Cornea 2021;40(12):1561–6.
[50] Ambekar R, Toussaint Jr KC, Wagoner Johnson A. The effect of keratoconus on the structural, mechanical, and optical properties of the cornea. J Mech Behav Biomed Mater 2011;4(3):223–36.
[51] Sykakis E, Carley F, Irion L, et al. An in depth analysis of histopathological characteristics found in keratoconus. Pathology 2012;44(3):234–9.
[52] Sawaguchi S, Fukuchi T, Abe H, et al. Three-dimensional scanning electron microscopic study of keratoconus corneas. Arch Ophthalmol 1998;116(1):62–8.
[53] Groeneveld-van Beek EA, Parker J, Lie JT, et al. Donor tissue preparation for Bowman layer transplantation. Cornea 2016;35(12):1499–502.
[54] Groeneveld-van Beek EdL J, Dapena I, Oellerich S, et al. Laser-assisted Bowman layer graft preparation. Investigative Ophthalmol Vis Sci 2022;63(7):3487.
[55] Barbosa Goncalves T, Forseto ADS, Martins AL, Pereira NC. Femtosecond laser-assisted Bowman layer transplantation for advanced keratoconus. Eur J Ophthalmol 2022;11206721221143163.
[56] Garcia de Oteyza G, Gonzalez Dibildox LA, Vazquez-Romo KA, et al. Bowman layer transplantation using a femtosecond laser. J Cataract Refract Surg 2019;45(3):261–6.
[57] van Dijk K, Liarakos VS, Parker J, et al. Bowman layer transplantation to reduce and stabilize progressive, advanced keratoconus. Ophthalmology 2015;122(5):909–17.
[58] Tourkmani AK, Mohammad T, McCance E, et al. One-year front versus central and paracentral corneal changes after Bowman layer transplantation for keratoconus. Cornea 2022;41(2):165–70.
[59] De Clerck EEB, Bravetti GE, Kropp M, et al. Bowman layer transplantation for treating keratoconus-preliminary findings. J Clin Med 2023 ;12(6):2402.
[60] Shah Z, Hussain I, Borroni D, et al. Bowman's layer transplantation in advanced keratoconus ; 18-months outcomes. Int Ophthalmol 2022 ;42(4):1161–73.
[61] Luceri S, Parker J, Dapena I, et al. Corneal densitometry and higher order aberrations after Bowman layer transplantation : 1-year results. Cornea 2016 ;35(7):959–66.
[62] Zygoura V, Birbal RS, van Dijk K, et al. Validity of Bowman layer transplantation for keratoconus : visual performance at 5–7 years. Acta Ophthalmol 2018 ;96(7):e901–2.
[63] Dragnea DC, Birbal RS, Ham L, et al. Bowman layer transplantation in the treatment of keratoconus. Eye Vis (Lond) 2018 ;5:24.
[64] Dapena I, Parker JS, Melles GRJ. Potential benefits of modified corneal tissue grafts for keratoconus : Bowman layer ‘inlay' and ‘onlay' transplantation, and allogenic tissue ring segments. Curr Opin Ophthalmol 2020 ;31(4):276–83.
[65] Parker JS, Dockery PW, Parker JS, et al. Bowman layer onlay graft for reducing fluctuation in visual acuity after previous radial keratotomy. Cornea 2020 ;39(10):1303–6.
[66] Dapena I, Musayeva A, Dragnea DC, et al. Bowman layer onlay transplantation to manage herpes corneal scar. Cornea 2020 ;39(9):1164–6.
[67] Mulders-Al-Saady R, van der Star L, van Dijk K, et al. Bowman layer onlay graft for recurrent corneal erosions in map-dot-fingerprint dystrophy. Cornea 2022 ;41(8):1062–3.
[68] Johns LK, Leon P, Cortes-Barrantes P, et al. Recurrent keratoconus : an analysis of breaks in Bowman's layer in corneal grafts. BMJ Open Ophthalmol 2023 ;8(1), e001225.
[69] Reyhan AH, Karadag AS, Cinar SS. Assessing the role of systemic inflammation in the etiopathogenesis of advanced stage keratoconus. Indian J Ophthalmol 2021 ;69(10):2658–62.
[70] Lema I, Sobrino T, Duran JA, et al. Subclinical keratoconus and inflammatory molecules from tears. Br J Ophthalmol 2009 ;93(6):820–4.
[71] Acar Eser N, Dikmetas O, Kocabeyoglu S, et al. Evaluation of keratoconus disease with tear cytokine and chemokine levels before and after corneal cross-linking treatment. Ocul Immunol Inflamm 2024 ;32(3):269–75.

47.2. Réhabilitation visuelle – Corrections optiques et réfraction subjective

[72] Santodomingo-Rubido J, Carracedo G, Suzaki A, et al. Keratoconus : an updated review. Contact Lens Anterior Eye 2022 ;45(3), 101559.
[73] Gu D, Andreev K, Dupre ME. Major trends in population growth around the world. China CDC Wkly 2021 ;3(28):604–13.
[74] Richter T, Nestler-Parr S, Babela R, et al. Rare disease terminology and definitions-A systematic global review : report of the ISPOR rare disease special interest group. Value Health J Int Soc Pharmacoeconomics Outcomes Res 2015 ;18(6):906–14.
[75] Rabinowitz YS. Keratoconus. Surv Ophthalmol 1998 ;42(4):297–319.
[76] Saunier V, Mercier AE, Gaboriau T, et al. Vision-related quality of life and dependency in French keratoconus patients : Impact study. J Cataract Refract Surg 2017 ;43(12):1582.
[77] Weed KH, Macewen CJ, McGhee CNJ. The Dundee University Scottish Keratoconus Study II : a prospective study of optical and surgical correction. Ophthalmic Physiol Opt 2007 ;27(6):561–7.
[78] Soeters N, Muijzer MB, Molenaar J, et al. Autorefraction versus manifest refraction in patients with keratoconus. J Refract Surg Thorofare NJ 1995 2018 ;34(1):30–4.
[79] Metzger M, Navel V, Barrière JV, et al. Benefits of using corneal topography to choose subjective refraction technique in keratoconus (RE-CON) : a prospective comparative crossover clinical study. Graefes Arch Clin Exp Ophthalmol 2022 ;260(1):197–207.
[80] Elkadim M, Nasef MH, Alagorie AR, Allam WA. Corneal topographic versus manifest refractive astigmatism in patients with keratoconus : a retrospective cross-sectional study. Clin Ophthalmol Auckl NZ 2022 ;16:2033–9.
[81] Alió JL, Shabayek MH. Corneal higher order aberrations : a method to grade keratoconus. J Refract Surg 2006 ;22(6):539–45.
[82] Maeda N, Fujikado T, Kuroda T, et al. Wavefront aberrations measured with Hartmann-Shack sensor in patients with keratoconus. Ophthalmology 2002 ;109(11):1996–2003.
[83] Nakagawa T, Maeda N, Kosaki R, et al. Higher-order aberrations due to the posterior corneal surface in patients with keratoconus. Invest Ophthalmol Vis Sci 2009 ;50(6):2660–5.
[84] Touzeau O, Scheer S, Allouch C, et al. Relation entre le kératocône et la myopie axile. J Fr Ophtalmol 2004 ;27(7):765–71.
[85] Kanclerz P. Results of the pinhole test correlate with hybrid contact lens visual acuity in patients with visual impairment due to corneal diseases. J Ophthalmol 2022 ;2022:4932856.
[86] Peyre C, Meillon JP. Réfraction manuelle sur kératocône : méthode de la fente sténopéique. Cah Ophtalmol 2013 ;168.
[87] Péchereau A. Réfraction de près. In: Pechereau AJ, editor. La réfraction. Nantes ; 2006. p. 67–75.
[88] Prévost G. Les verres filtrants. In : Basse Vision Pratique. Essilor. p. 24-7. (Les cahiers d'optiques oculaire).
[89] Rampat R, Debellemanière G, Malet J, Gatinel D. Using artificial intelligence and novel polynomials to predict subjective refraction. Sci Rep 2020 ;10(1):8565.
[90] Vandevenne MM, Favuzza E, Veta M, et al. Artificial intelligence for detecting keratoconus. Cochrane Database Syst Rev 2021 ;2021(12):CD014911.

Contactologie

[91] Gomes JAP, Tan D, Rapuano CJ, et al. Global consensus on keratoconus and ectatic diseases. Cornea 2015 ;34(4):359–69.

[92] Downie LE, Lindsay RG. Contact lens management of keratoconus. Clin Exp Optom 2015 ;98(4):299–311.
[93] Barnett M, Mannis MJ. Contact lenses in the management of keratoconus. Cornea 2011 ;30(12):1510–6.
[94] Adaptation en lentilles du kératocône en fonction du stade évolutif. In : Le kératocone. (Rapport SFOALC 2015).
[95] Galvis V, Tello A, Carreño NI, et al. Scleral lenses reduce the need for corneal transplants in severe keratoconus. Am J Ophthalmol 2018 ;190:202–3.

Anneaux intracornéens

[96] Patel S, Marshall J, Fitzke 3rd FW. Model for deriving the optical performance of the myopic eye corrected with an intracorneal ring. J Refract Surg 1995 ;11(4):248–52.
[97] Ertan A, Colin J. Intracorneal rings for keratoconus and keratectasia. J Cataract Refract Surg 2007 ;33(7):1303–14.
[98] Colin J, Cochener B, Savary G, Malet F. Correcting keratoconus with intracorneal rings. J Cataract Refract Surg 2000 ;26(8):1117–22.
[99] Shabayek MH, Alió JL. Intrastromal corneal ring segment implantation by femtosecond laser for keratoconus correction. Ophthalmology 2007 ;114(9):1643–52.
[100] Piñero DP, Alio JL. Intracorneal ring segments in ectatic corneal disease - a review. Clin Exp Ophthalmol 2010 ;38(2):154–67.
[101] Jacob S, Agarwal A, Awwad ST, et al. Customized corneal allogenic intrastromal ring segments (CAIRS) for keratoconus with decentered asymmetric cone. Indian J Ophthalmol 2023 ;71(12):3723–9.
[102] Touboul D, Pinsard L, Mesplier N, et al. Correction des astigmatismes irréguliers par anneaux intracornéens [Correction of irregular astigmatism with intracorneal ring segments]. J Fr Ophtalmol 2012 ;35(3):212–9.
[103] Terai N, Raiskup F, Haustein M, et al. Identification of biomechanical properties of the cornea : the ocular response analyzer. Curr Eye Res 2012 ;37(7):553–62.
[104] Singh C, Joshi VP. Cataract surgery in Keratoconus revisited - An update on preoperative and intraoperative considerations and postoperative outcomes. Semin Ophthalmol 2023 ;38(1):57–64.
[105] Leccisotti A. Bioptics : where do things stand ? Curr Opin Ophthalmol 2006 ;17(4):399–405.
[106] Nowrouzi A, D'Oria F, Alió Del Barrio JL, Alió JL. Phakic intraocular Lens implantation in keratoconus patients. Eur J Ophthalmol 2024 ;34(5):1365–72.
[107] D'Oria F, Bagaglia SA, Alio Del Barrio JL, et al. Refractive surgical correction and treatment of keratoconus. Surv Ophthalmol 2024 ;69(1):122–39.
[108] Luis Izquierdo Jr., MD, MSc, PhD. Effectiveness of intrastromal corneal ring implantation in the treatment of adult patients with keratoconus : a systematic review. J Refract Surg 2019 ;35(3):191–200.
[109] Avni-Zauberman N, Rootman DS. Cross-linking and intracorneal ring segments—Review of the literature. Eye Contact Lens 2014 ;40(6):365–70.
[110] Nasrat MM, Abdelsalam AM, Goily MB, et al. Keratometric outcomes after simultaneous versus sequential intracorneal ring segment implantation with femtosecond laser and corneal collagen crosslinking in Egyptian patients with keratoconus and ectasia. J Microsc Ultrastruct 2022 ;12(1):35–42.
[111] Ezzeldin M, Filev F, Steinberg J, Frings A. Excimer laser treatment combined with riboflavin ultraviolet-A (UVA) collagen crosslinking (CXL) in keratoconus : a literature review. Int Ophthalmol 2020 ;40(9):2403–12.
[112] Benoist d'Azy C, Pereira B, Chiambaretta F, Dutheil F. Efficacy of different procedures of intra-corneal ring segment implantation in keratoconus : a systematic review and meta-analysis. Transl Vis Sci Technol 2019 ;8(3):38.
[113] Janani L, Tanha K, Najafi F, et al. Efficacy of complete rings (MyoRing) in treatment of keratoconus : a systematic review and meta-analysis. Int Ophthalmol 2019 ;39(12):2929–46.

Focus sur les anneaux progressifs

[114] Ahmet S, Yayla Akincilar G, Kirgiz A, et al. Long-term results of accelerated corneal collagen crosslinking in paediatric patients with progressive keratoconus : 10-year follow-up. Eye (Lond) 2024 ;38(13):2522–9.
[115] McLintock CA, McKelvie J, Miraflores-Gomez S, et al. Outcomes of sequential intracorneal ring segment and phakic intraocular lens insertion for visual rehabilitation in keratoconus. Eur J Ophthalmol 2021 ;31(5):2219–26.
[116] Niazi S, Doroodgar F, Hashemi Nazari S, et al. Refractive surgical approaches to keratoconus : A systematic review and network meta-analysis. Surv Ophthalmol 2024 ;69(5):779–88.
[117] Prisant O, Pottier E, Guedj T, Hoang Xuan T. Clinical outcomes of an asymmetric model of intrastromal corneal ring segments for the correction of keratoconus. Cornea 2020 ;39(2):155–60.
[118] Coşkunseven E, Ambrósio R, Smorádková A, et al. Visual, refractive and topographic outcomes of progressive thickness intrastromal corneal ring segments for keratoconic eyes. Int Ophthalmol 2020 ;40(11):2835–44.
[119] Baptista PM, Marques JH, Neves MM, et al. Asymmetric thickness intracorneal ring segments for keratoconus. Clin Ophthalmol 2020 ;14:4415–21.
[120] Coskunseven E, Kayhan B. Clinical, tomographic, and topometric outcomes of progressive thickness intracorneal ring segment implantations in duck-type keratoconus. Indian J Ophthalmol 2022 ;70(8):2939.
[121] Barugel R, David C, Kallel S, et al. Comparative study of asymmetric versus non-asymmetric intrastromal corneal ring segments for the management of keratoconus. J Refract Surg 2021 ;37(8):552–61.
[122] Arbelaez JG, Arbelaez MC. Efficacy of progressive thickness intrastromal corneal ring segments in the treatment of duck phenotype keratoconus. Eur J Ophthalmol 2021 ;31(5):2191–9.
[123] Coskunseven E, Kayhan B. Asymmetric intracorneal ring segments in the treatment of snowman phenotype keratoconus. J Fr Ophtalmol 2023 ;46(5):510–7.
[124] Alió JL, Shabayek MH, Belda JI, et al. Analysis of results related to good and bad outcomes of intacs implantation for keratoconus correction. J Cataract Refract Surg 2006 ;32(5):756–61.
[125] Utine CA, Özizmirliler D, Kayabaşı M, Günenç Ü. The number of intracorneal ring segments in asymmetric and central cones. Eye and Vis 2021 ;8(1):10.
[126] Kammoun H, Piñero DP, Álvarez de Toledo J, et al. Clinical outcomes of femtosecond laser-assisted implantation of asymmetric ICRS in keratoconus with no coincidence of topographic and comatic axes. J Refract Surg 2021 ;37(10):693–9.
[127] Cuiña Sardiña R, Arango A, Alfonso JF, et al. Clinical evaluation of the effectiveness of asymmetric intracorneal ring with variable thickness and width for the management of keratoconus. J Cataract Refract Surg 2021 ;47(6):722–30.
[128] Benlarbi A, Kallel S, David C, et al. Asymmetric iIntrastromal corneal ring segments with progressive base width and thickness for keratoconus : evaluation of efficacy and analysis of epithelial remodeling. J Clin Med 2023 ;12(4):1673.

Greffes de cornée

[129] Rabinowitz YS. Keratoconus. Surv Ophthalmol 1998 ;42(4):297–319.
[130] Fuentes E, Sandali O, El Sanharawi M, et al. Anatomic predictive factors of acute corneal hydrops in keratoconus : an optical coherence tomography study. Ophthalmology 2015 ;122(8):1653–9.
[131] Melles GRJ, Remeijer L, Geerards AJ, Beekhuis WH. A quick surgical technique for deep, anterior lamellar keratoplasty using visco-dissection. Cornea 2000 ;19(4):427–32.
[132] Anwar M, Teichmann KD. Big-bubble technique to bare Descemet's membrane in anterior lamellar keratoplasty. J Cataract Refract Surg 2002 ;28(3):398–403.
[133] Fournié P, Malecaze F, Coullet J, Arné JL. Variant of the big bubble technique in deep anterior lamellar keratoplasty. J Cataract Refract Surg 2007 ;33(3):371–5.
[134] Dua HS, Faraj LA, Said DG, et al. Human corneal anatomy redefined : a novel pre-Descemet's layer (Dua's layer). Ophthalmology 2013 ;120(9):1778–85.
[135] Reinhart WJ, Musch DC, Jacobs DS, et al. Deep anterior lamellar keratoplasty as an alternative to penetrating keratoplasty a report by the American Academy of Ophthalmology. Ophthalmology 2011 ;118(1):209–18.

[136] Cheng YY, Visser N, Schouten JS, et al. Endothelial cell loss and visual outcome of deep anterior lamellar keratoplasty versus penetrating keratoplasty : a randomized multicenter clinical trial. Ophthalmology 2011 ;118(2):302–9.
[137] Arundhati A, Chew MC, Lim L, et al. Comparative study of long-term graft survival between penetrating keratoplasty and deep anterior lamellar keratoplasty. Am J Ophthalmol 2021 ;224:207–16.
[138] Ardjomand N, Hau S, McAlister JC, et al. Quality of vision and graft thickness in deep anterior lamellar and penetrating corneal allografts. Am J Ophthalmol 2007 ;143(2):228–35.
[139] Schaub F, Enders P, Bachmann BO, et al. Effect of corneal collagen crosslinking on subsequent deep anterior lamellar keratoplasty (DALK) in keratoconus. Graefes Arch Clin Exp Ophthalmol 2017 ;255(4):811–6.
[140] Kubaloglu A, Koytak A, Sari ES, et al. Corneal endothelium after deep anterior lamellar keratoplasty and penetrating keratoplasty for keratoconus : a four-year comparative study. Indian J Ophthalmol 2012 ;60(1):35–40.
[141] Borderie VM, Georgeon C, Sandali O, Bouheraoua N. Long-term outcomes of deep anterior lamellar versus penetrating keratoplasty for keratoconus. Br J Ophthalmol 2023 ;108(1):10–6.
[142] Liu H, Chen Y, Wang P, et al. Efficacy and safety of deep anterior lamellar keratoplasty vs. penetrating keratoplasty for keratoconus : a meta-analysis. PLoS One 2015 ;10(1), e0113332.
[143] Maharana PK, Agarwal K, Jhanji V, Vajpayee RB. Deep anterior lamellar keratoplasty for keratoconus : a review. Eye Contact Lens 2014 ;40(6):382–9.
[144] Parker JS, Birbal RS, van Dijk K, et al. Are Descemet membrane ruptures the root cause of corneal hydrops in keratoconic eyes ? Am J Ophthalmol 2019 ;205:204–5.
[145] Yahia Chérif H, Gueudry J, Afriat M, et al. Efficacy and safety of pre-Descemet's membrane sutures for the management of acute corneal hydrops in keratoconus. Br J Ophthalmol 2015 ;99(6):773–7.
[146] Bachmann B, Händel A, Siebelmann S, et al. Mini-Descemet membrane endothelial keratoplasty for the early treatment of acute corneal hydrops in keratoconus. Cornea 2019 ;38(8):1043–8.
[147] Anwar HM, Anwar M. Predescemetic dissection for healed hydrops- -judicious use of air and fluid. Cornea 2011 ;30(12):1502–9.
[148] Ahadi M, Ramin S, Abbasi A, et al. Mini review : human clinical studies of stem cell therapy in keratoconus. BMC Ophthalmol 2024 ;24(1):35.
[149] Dou S, Liu X, Shi W, Gao H. New dawn for keratoconus treatment : potential strategies for corneal stromal regeneration. Stem Cell Res Ther 2023 ;14(1):317.
[150] Alió Del Barrio JL, De la Mata A, De Miguel MP, et al. Corneal regeneration using adipose-derived mesenchymal stem cells. Cells 2022 ;11(16):2549.
[151] Rafat M, Jabbarvand M, Sharma N, et al. Bioengineered corneal tissue for minimally invasive vision restoration in advanced keratoconus in two clinical cohorts. Nat Biotechnol 2023 ;41(1):70–81.
[152] Coullet J, Fournié P, Malecaze F, Arné JL. Inadequate results for microkeratome-assisted additive stromal keratoplasty for management of keratoconus. J Refract Surg 2008 ;24(2):166–72.
[153] Nubile M, Salgari N, Mehta JS, et al. Epithelial and stromal remodeling following femtosecond laser-assisted stromal lenticule addition keratoplasty (SLAK) for keratoconus. Sci Rep 2021 ;11(1):2293.
[154] Jacob S, Patel SR, Agarwal A, et al. Corneal Allogenic Intrastromal Ring Segments (CAIRS) combined with corneal cross-linking for keratoconus. J Refract Surg 2018 ;34(5):296–303.
[155] Bteich Y, Assaf JF, Mrad AA, et al. Corneal Allogenic Intrastromal Ring Segments (CAIRS) for corneal ectasia : a comprehensive segmental tomography evaluation. J Refract Surg 2023 ;39(11):767–76.

Photokératectomies

[156] Kanellopoulos AJ. Combined photorefractive keratectomy and corneal cross-linking for keratoconus and ectasia : the Athens protocol. Cornea 2023 ;42(10):1199–205.
[157] Wong JJ, Papakostas AD, Kanellopoulos AJ, Sperber LT. Post-lasik ectasia : PRK following previous stabilization and effective management with riboflavin/ultraviolet A-induced collagen crosslinking. Invest Ophthalmol Vis Sci 2006 ;47(13):557.
[158] Kanellopoulos AJ, Binder PS. Collagen Cross-Linking (CCL) with sequential topography-guided PRK : a temporizing alternative for keratoconus to penetrating keratoplasty. Cornea 2007 ;26(7):891–5.
[159] Kanellopoulos AJ. Comparison of sequential vs same-day simultaneous collagen coss-linking and topography-guided PRK for treatment of keratoconus. J Refract Surg 2009 ;25(S3).
[160] Padmanabhan P, Radhakrishnan A, Venkataraman AP, et al. Corneal changes following collagen cross linking and simultaneous topography guided photoablation with collagen cross linking for keratoconus. Indian J Ophthalmol 2014 ;62(2):229–35.
[161] Kanellopoulos AJ, Binder PS. Management of corneal ectasia after LASIK with combined, same-day, topography-guided partial transepithelial PRK and collagen cross-linking : the Athens protocol. J Refract Surg 2011 ;27(5):323–31.
[162] Kanellopoulos AJ. Ten-year outcomes of progressive keratoconus management with the Athens protocol (topography-guided partial-refraction PRK combined with CXL). J Refract Surg 2019 ;35(8):478–83.
[163] Alessio G, L'abbate M, Sborgia C, La Tegola MG. Photorefractive keratectomy followed by cross-linking versus cross-linking alone for management of progressive keratoconus : two-year follow-up. Am J Ophthalmol 2013 ;155(1):54–65.e1.
[164] Kymionis G, Kontadakis G, Grentzelos M, Petrelli M. Long-term follow-up of combined photorefractive keratectomy and corneal crosslinking in keratoconus suspects. OPTH 2021 ;15:2403–10.
[165] Santos R, Siqueira JA, Dias LC, et al. Long-term improvement after the Athens protocol for advanced keratoconus with significant ectasia progression in the fellow eye. Int J Keratoconus Ectatic Corneal Dis 2013 ;2(3):143–6.
[166] Ewald M, Kanellopoulos J. Limited Topography-Guided Surface Ablation (TGSA) followed by stabilization with collagen crosslinking with UV irradiation & riboflavin (UVACCL) for keratoconus (KC). Invest Ophthalmol Vis Sci 2008 ;49(13):4338.
[167] Cho MY, Kanellopoulos AJ. Short and long-term complications of combined topography-guided photorefractive keratectomy and riboflavin/ultraviolet a corneal collagen cross-linking (the Athens protocol) in 412 keratoconus eyes. Invest Ophthalmol Vis Sci 2011 ;52(14):5202.
[168] Mazharian A, Flamant R, Elahi S, et al. Medium to long term follow up study of the efficacy of cessation of eye-rubbing to halt progression of keratoconus. Front Med (Lausanne) 2023 ;10:1152266.
[169] Grentzelos MA, Kounis GA, Diakonis VF, et al. Combined transepithelial phototherapeutic keratectomy and conventional photorefractive keratectomy followed simultaneously by corneal crosslinking for keratoconus : Cretan protocol plus. J Cataract Refract Surg 2017 ;43(10):1257–62.
[170] Al-Mohaimeed MM. Combined corneal CXL and photorefractive keratectomy for treatment of keratoconus : a review. Int J Ophthalmol 2019 ;12(12):1929–38.
[171] Kanellopoulos AJ. Keratoconus management with customized photorefractive keratectomy by artificial intelligence ray-tracing optimization combined with higher fluence corneal crosslinking : the ray-tracing Athens protocol. Cornea 2021 ;40(9):1181–7.
[172] Mazzotta C, Stojanovic A, Romano V, et al. Ray-tracing transepithelial excimer laser central corneal remodeling plus pachymetry-guided accelerated corneal crosslinking for keratoconus. Cornea 2024 ;43(3):285–94.
[173] Randleman JB. Post-laser in-situ keratomileusis ectasia : current understanding and future directions. Curr Opin Ophthalmol 2006 ;17(4):406–12.
[174] Santodomingo-Rubido J, Carracedo G, Suzaki A, et al. Keratoconus : an updated review. Contact Lens Anterior Eye 2022 ;45(3), 101559.
[175] Bahar I, Levinger S, Kremer I. Wavefront-supported photorefractive keratectomy with the Bausch & Lomb zyoptix in patients with myopic astigmatism and suspected keratoconus. J Refract Surg 2006 ;22(6):533–8.
[176] Alpins N, Stamatelatos G. Customized photoastigmatic refractive keratectomy using combined topographic and refractive data for myopia and astigmatism in eyes with forme fruste and mild keratoconus. J Catar Refract Surg 2007 ;33(4):591–602.

[177] Bilgihan K, Ozdek SC, Konuk O, et al. Results of photorefractive keratectomy in keratoconus suspects at 4 years. J Refract Surg 2000 ;16(4):438–43.
[178] Guedj M, Saad A, Audureau E, Gatinel D. Photorefractive keratectomy in patients with suspected keratoconus : five-year follow-up. J Cataract Refract Surg 2013 ;39(1):66–73.
[179] Chelala E, Rami HE, Dirani A, et al. Photorefractive keratectomy in patients with mild to moderate stable keratoconus : a five-year prospective follow-up study. Clin Ophthalmol 2013 ;7:1923–8.
[180] Cennamo G, Intravaja A, Boccuzzi D, et al. Treatment of keratoconus by topography-guided customized photorefractive keratectomy : two-year follow-up study. J Refract Surg 2008 ;24(2):145–9.
[181] Tambe DS, Ivarsen A, Hjortdal J. Photorefractive keratectomy in keratoconus. Case Rep Ophthalmol 2015 ;6(2):260–8.
[182] Colin J, Cochener B, Savary G, Malet F. Correcting keratoconus with intracorneal rings. J Cataract Refract Surg 2000 ;26(8):1117–22.
[183] Iovieno A, Légaré ME, Rootman DB, et al. Intracorneal ring segments implantation followed by same-day photorefractive keratectomy and corneal collagen cross-linking in keratoconus. J Refract Surg 2011 ;27(12):915–8.
[184] Gupta A, Huang S, Sun MT, Zamora-Alejo K. Intrastromal corneal ring segment implantation followed by simultaneous topography-guided photorefractive keratectomy and corneal cross-linking for contact lens-itolerant keratoconus. Cornea 2024 ;43(3):307–14.
[185] d'Azy CB, Pereira B, Chiambaretta F, Dutheil F. Efficacy of different procedures of intra-corneal ring segment implantation in keratoconus : a systematic review and meta-analysis. Trans Vis Sci Tech 2019 ;8(3):38.
[186] Alsubhi AH, Alhindi N, Abukhudair A, et al. Safety and efficacy of laser refractive procedure in eyes with previous keratoplasty - A systematic review and meta-analysis. J Cataract Refract Surg 2023 ;49(12):1275–82.
[187] Northey LC, Holland SP, Lin DTC, Moloney G. New treatment algorithm for keratoconus and cataract : small-aperture IOL insertion with sequential topography-guided photorefractive keratectomy and simultaneous accelerated corneal crosslinking. J Cataract Refract Surg 2021 ;47(11):1411–6.
[188] Coskunseven E, Sharma DP, Grentzelos MA, et al. Four-stage procedure for keratoconus : ICRS implantation, Corneal cross-linking, Toric Phakic intraocular lens implantation, and topography-guided photorefractive keratectomy. J Refract Surg 2017 ;33(10):683–9.

Implants phaques

[189] Kalra N, Asif MI, Bafna RK, et al. Posterior chamber phakic intraocular lens implantation for refractive correction in corneal ectatic disorders : a review. J Refract Surg 2021 ;37(5):351–9.
[190] He C, Joergensen JS, Knorz MC, McKay KN, Zhang F. Three-step treatment of keratoconus and post-LASIK ectasia : implantation of ICRS, corneal cross-linking, and implantation of toric posterior chamber phakic IOLs. J Refract Surg 2020 ;36(2):104–9.
[191] Fairaq R, Almutlak M, Almazyad E, et al. Outcomes and complications of implantable collamer lens for mild to Advance keratoconus. Int Ophthalmol 2021 ;41(7):2609–18.
[192] Fischinger IR, Wendelstein J, Tetz K, et al. Toric phakic IOLs in keratoconus-evaluation of preoperative parameters on the outcome of phakic anterior chamber lens implantation in patients with keratoconus. Graefes Arch Clin Exp Ophthalmol 2021 ;259(6):1643–9.

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[193] Bozorg S, Pineda R. Cataract and keratoconus : minimizing complications in intraocular lens calculations. Semin Ophthalmol 2014 ;29(5-6):376–9.
[194] Singh C, Joshi VP. Cataract surgery in keratoconus revisited - An update on preoperative and intraoperative considerations and postoperative outcomes. Semin Ophthalmol 2023 ;38(1):57–64.
[195] Moshirfar M, Walker BD, Birdsong OC. Cataract surgery in eyes with keratoconus : a review of the current literature. Curr Opin Ophthalmol 2018 ;29(1):75–80.
[196] Ton Y, Barrett GD, Kleinmann G, et al. Toric intraocular lens power calculation in cataract patients with keratoconus. J Cataract Refract Surg 2021 ;47(11):1389–97.
[197] Yahalomi T, Achiron A, Hecht I, et al. Refractive outcomes of non-toric and toric intraocular lenses in mild, moderate and advanced keratoconus : a systematic review and meta-analysis. J Clin Med 2022 ;11(9):2456.
[198] Gonzalez-Salinas R, Franco JJ, Reyes-Luis JL, et al. Cataract surgery in patients with underlying keratoconus : focused review. J Cataract Refract Surg 2023 ;49(1):97–102.
[199] Savini G, Abbate R, Hoffer KJ, et al. Intraocular lens power calculation in eyes with keratoconus. J Cataract Refract Surg 2019 ;45(5):576–81.
[200] Coskunseven E, Sharma DP, Grentzelos MA, et al. Four-stage procedure for keratoconus : ICRS implantation, corneal cross-linking, toric phakic intraocular lens implantation, and topography-guided photorefractive keratectomy. J Refract Surg 2017 ;33(10):683–9.
[201] Benoist d'Azy C, Pereira B, Chiambaretta F, Dutheil F. Efficacy of different procedures of intra-corneal ring segment implantation in keratoconus : a systematic review and meta-analysis. Transl Vis Sci Technol 2019 ;8(3):38.

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[202] Rabinowitz YS, Galvis V, Tello A, et al. Genetics vs chronic corneal mechanical trauma in the etiology of keratoconus. Exp Eye Res 2021 ;202, 108328.
[203] Lapeyre G, Fournie P, Vernet R, et al. Keratoconus prevalence in families : a French study. Cornea 2020 ;39(12):1473–9.
[204] D'Oria F, Bagaglia SA, Alio Del Barrio JL, et al. Refractive surgical correction and treatment of keratoconus. Surv Ophthalmol 2024 ;69(1):122–39.
[205] Moraes RLB, Ghanem RC, Ghanem VC, et al. Haze and visual acuity loss after sequential photorefractive keratectomy and corneal cross-linking for keratoconus. J Refract Surg 2019 ;35(2):109–14.
[206] Santodomingo-Rubido J, Carracedo G, Suzaki A, et al. Keratoconus : an updated review. Cont Lens Anterior Eye 2022 ;45(3), 101559.
[207] Deshmukh R, Ong ZZ, Rampat R, et al. Management of keratoconus : an updated review. Front Med (Lausanne) 2023 ;10:1212314.