

DAFTAR PUSTAKA

- Abad, J. C. dan Panesso, J. L. 2008. "Corneal Collagen Cross-linking Induced by UVA and Riboflavin (CXL)," *Tech. Ophthalmol.*, 6(1), hal. 8–12.
- Abrahamsson M, Fabian G & Sjostrand J. Refraction changes in children developing convergent or divergent strabismus. *Br J Ophthalmol* 1992; 76: 723–727
- Aghaian E, Choe JE, Lin S, Stamper RL. Central corneal thickness of Caucasians, Chinese, Hispanics, Filipinos, African Americans, and Japanese in a glaucoma clinic. *Ophthalmology*. 2004;111(12): 211–2219.
- Akinci A, G€uv€en A, Degerliyurt A, Kibar E, Mutlu M & Citirik M. The correlation between headache and refractive errors. *J AAPOS* 2008; 12: 290–293
- Bailey, A. Structure, function and ageing of the collagens of the eye. *Eye* 1, 175–183 (1987). <https://doi.org/10.1038/eye.1987.34>
- Bhandari, G. (2016) 'Eye Glasses Compliance among Children Undergoing School Visual Acuity Screening in Nepal', *Advances in Ophthalmology & Visual System*, 5(3), pp. 1–5. doi: 10.15406/aovs.2016.05.00162.
- Brandt JD, Beiser JA, Kass MA, Gordon MO. Central corneal thickness in the Ocular Hypertension Treatment Study (OHTS). *Ophthalmology*. 2001;108(10):1779–1788.
- Bykhovskaya Y, Li X, Epifantseva I, Haritunians T, Siscovick D, Aldave A, Szczotka-Flynn L, Iyengar SK, Taylor KD, Rotter JI, Rabinowitz YS. Variation in the lysyl oxidase (LOX) gene is associated with keratoconus in family-based and case control studies. *Invest Ophthalmol Vis Sci* 2012; 53:4152–4157

Cheema, A. S., Mozayan, A. dan Channa, P. 2012. “Corneal collagen crosslinking in refractive surgery,” *Curr. Opin. Ophthalmol.*, 23(4), hal. 251–256.

Cifariello, F., Minicucci, M., Di Renzo, F., Di Taranto, D., Coclite, G., et al. 2018. “Epi-Off versus Epi-On Corneal Collagen Cross-Linking in Keratoconus Patients: A Comparative Study through 2-Year Follow-Up,” *J. Ophthalmol.* Hindawi, 2018, hal. 1–6

De Bernardo M, et al. Long-term results of corneal collagen crosslinking for progressive keratoconus. *J Optom.* (2014)

<http://dx.doi.org/10.1016/j.optom.2014.05.006>

Edman, A. H. and Ström, L. (2019) ‘Corneal cross - linking (CXL)— A clinical study to evaluate CXL as a treatment in comparison with medical treatment for ulcerative keratitis in horses’, (October 2018), pp. 1–11. doi: 10.1111/vop.12662.

Davidson AE, Hayes S, Hardcastle AJ, Tuft SJ. The pathogenesis of keratoconus. *Eye (Lond).* 2014;28(2):189-195. doi:10.1038/eye.2013.278

Dawson, D. G., Ubels, J. L. dan Edelhauser, H. F. 2011. “Keratometry, Corneal Topography, and Corneal Tomography,” in Levin, L. A., Nilsson, S. F. E., Hoeve, J. Ver, Wu, S. M., Kaufman, P. L., et al. (ed.) *Adler’s Physiol. eye.* 11 65 ed. Elsevier’s.

Dawson DG, Warsky MA, Geroski DH, Edelhauser HF. Duane’s Foundation of Clincal Ophthalmology on CD Rom Vol. 2c. Philadelphia: Lippincott Williams & Wilkins. 2006:1-76.

Dawson, D., Ubels, J. dan Edelahauser, H. 2011. “Cornea and sclera,” in Levin, L. A., Nilsson, S. F. E., Hoeve, J. Ver, Wu, S. M., Kaufman, P. L., et al. (ed.) *Adler’s Physiol. eye.* 11 ed. Elsevier’s.



Eballe AO, Koki G, Ellong A, Owono D, Epee E, Bella LA. Central corneal thickness and intraocular pressure in the Cameroonian non glaucomatous population. *Clin Ophthalmol.* 2010;4:717–724.

Elmohamady MN, Abdelghaffar W, Salem TI. Tear Martix Metalloproteinase-9 and Tissue Inhibitor of Metalloproteinase-1 in Post-Lasik Ectasia. *Int Ophthalmol.* 2019;39(3):631-637. doi:10.1007/s10792-018-0861-y

Fini ME, Cook JR, Mohan R, Brinckerhoff CE. Regulation of matrix metalloproteinase gene expression. In: Parks WC, Mecham RP, eds. *Matrix Metalloproteinases*. San Diego, CA: Academic Press; 1998:300-339. .

Gomes JA, Tan D, Rapuano CJ, Belin MW, Ambrosio R Jr., Guell JL, et al. Global consensus on keratoconus and ectatic diseases. *Cornea.* 2015; 34(4):359±69. Epub 2015/03/05. <https://doi.org/10.1097/ICO.0000000000000408> PMID: 25738235.

Goosey JD, Zigler JS, Kinoshita JH. Cross-linking of lens crystallins in a photodynamic system: A process mediated by singlet oxygen. *Science.* 1980;208:1278–1280

Greenstein SA, Shah VP, Fry KL, Hersh PS. Corneal thickness changes after corneal collagen crosslinking for keratoconus and corneal ectasia: one-year results. *J Cataract Refract Surg.* 2011;37(4):691-700. doi:10.1016/j.jcrs.2010.10.052

Groblewska M, Siewko M, Mroczko B, Szmirkowski M. The role of matrix metalloproteinases (MMPs) and their inhibitors (TIMPs) in the development of esophageal cancer. *Folia Histochem Cytobiol.* 2012; 50:12-19

Han S, Chen P, Fan Q et al. Association of variants in FRAP1 and PDGFRA with corneal curvature in Asian populations from Singapore. *Hum Mol Genet* 2011; 20: 3693–3698.



Hashemi, H. *et al.* (2017) ‘ScienceDirect Global and regional estimates of prevalence of refractive errors : Systematic review and meta-analysis’, *J. Curr Ophthalmol.* Elsevier Ltd. doi: 10.1016/j.joco.2017.08.009.

Holopainen JM, Krootila K. Transient corneal thinning in eyes undergoing corneal cross-linking. *Am J Ophthalmol.* 2011;152(4):533-536. doi:10.1016/j.ajo.2011.03.023

Hong CW, Sinha-Roy A, Schoenfield L, McMahon JT, Dupps WJ Jr. Collagenase-mediated tissue modeling of corneal ectasia and collagen cross-linking treatments. *Invest Ophthalmol Vis Sci.* 2012 Apr 30;53(4):2321-7. doi: 10.1167/iovs.11-9327. PMID: 22427568.

Hyun, S., Lee, S. and Kim, J. H. (2017) ‘Visual outcomes after SMILE, LASEK, and LASEK combined with corneal collagen cross-linking for high myopic correction’, *Cornea*, 36(4), pp. 399– 405. doi: 10.1097/ICO.0000000000001089.

Jia HZ, Pang X, Peng XJ. Changes of matrix metalloproteinases in the stroma after corneal cross-linking in rabbits. *Int J Ophthalmol.* 2021 Jan 18;14(1):26-31. doi: 10.18240/ijo.2021.01.04. PMID: 33469480; PMCID: PMC7790665.

Kagan HM, Trackman PC. Properties and function of lysyl oxidase. *Am J Respir Cell Mol Biol* 1991; 5:206–210

Kalangi, W., Rares, L. dan Sumual, V. 2016. “KELAINAN REFRAKSI DI POLIKLINIK MATA RSUP PROF. DR. R. D. KANDOU MANADO PERIODE JULI 2014-JULI 2016,” *J. Kedokt. Klin.*, 1(1), hal. 83–91.

Kocak I, Aydin A, Kaya F, Koc H. Comparison of transepithelial corneal collagen crosslinking with epithelium-off crosslinking in progressive keratoconus. *J Fr Ophtalmol* 2014; 37:371–376



Koller, T., Mrochen, M. dan Seiler, T. 2009. “Complication and failure rates after corneal crosslinking,” *J. Cataract Refract. Surg.* Elsevier, 35(8), hal. 1358– 1362.

Koller, T., Pajic, B., Vinciguerra, P., & Seiler, T. (2011). *Flattening of the cornea after collagen crosslinking for keratoconus. Journal of Cataract & Refractive Surgery*, 37(8), 1488–1492. doi:10.1016/j.jcrs.2011.03.041

Kolozsvári BL, Berta A, Petrovski G, et al. Alterations of tear mediators in patients with keratoconus after corneal crosslinking associate with corneal changes. *PLoS One.* 2013;8(10):e76333. Published 2013 Oct 4. doi:10.1371/journal.pone.0076333

Krisna D.P. Jati, Suhardjo, Tri W. Widayanti. Efektifitas *Photoactivated Collagen Cross-Linking* Kornea dengan Riboflavin untuk Koreksi Miopia Ringan. Departemen Ilmu Kesehatan Mata Fakultas Kedokteran, Kesehatan Masyarakat, dan Keperawatan Universitas Gadjah Mada/RS Sardjito Yogyakarta, 2018.

Kymionis GD, Kounis GA, Portaliou DM, et al. Intraoperative pachymetric measurements during corneal cross-linking with riboflavin and ultraviolet A irradiation. *Ophthalmology* 2009;116(12):2336 –2339

Leskul M, Aimpun P, Nawanopparatskul B, et al. The correlations between central corneal thickness and age, gender, intraocular pressure and refractive error of aged 12–60. *J Med Assoc Thai.* 2005;88 Suppl 3: S175–S179.

Levene JR. Sir George Biddell Airy FRS (1801–1892) and the discovery and correction of astigmatism. *Notes Rec R Soc Lond* 1966; 21: 180–199

Linsenmayer TF. Collagen. In: Hay ED, ed. *Cell biology of the extracellular matrix*. New York: Plenum Press, 1981:5-37.

Liu C, Feng P, Li X, Song J, Chen W. Expression of MMP-2, MT1-MMP, and TIMP-2 by cultured rabbit corneal fibroblasts under mechanical stretch. *Exp Biol Med (Maywood)*. 2014;239(8):907-912. doi:10.1177/1535370214536650

Lopes MC, Hysi PG, Verhoeven VJM et al. *Identification of a candidate gene for astigmatism*. Invest Ophthalmol Vis Sci 2013; 54: 1260–1267

Loukovitis, E. et al. (2019) ‘The Proteins of Keratoconus: a Literature Review Exploring Their Contribution to the Pathophysiology of the Disease’, *Advances in Therapy*. Springer Healthcare, 36(9), pp. 2205–2222. doi: 10.1007/s12325-019-01026-0.

Lu, C., Han, Z., Liu, G., Cai, X., Chen, Y., et al. 2001. “Photophysical and photochemical processes of riboflavin (vitamin B2) by means of the transient absorption spectra in aqueous solution,” *Sci. China Ser. B Chem.* Science Press, 44(1), hal. 39–48.

Lyall, D. A. M. et al. (2014) ‘Changes in corneal astigmatism among patients with visually significant cataract’, *Can. J. Ophthalmology*. Elsevier, 49(3), pp. 297–303. doi:10.1016/j.jcjo.2014.02.001.

M. Cristina Kenney (2005). Increased Levels of Catalase and Cathepsin V/L2 but Decreased TIMP-1 in Keratoconus Corneas: Evidence that Oxidative Stress Plays a Role in This Disorder. *Investigative Ophthalmology & Visual Science*, March 2005, Vol. 46, No. 5, pp: 823-833.

Magli A, Forte R, Tortori A, Capasso L, Marsico G, Piozzi E. Epithelium-off corneal collagen cross-linking versus transepithelial cross-linking for pediatric keratoconus. *Cornea* 2013; 32:597–601

Maguen, E. et al. (2002) ‘Extracellular matrix and matrix metalloproteinase changes in human corneas after complicated laser-assisted in situ keratomileusis (LASIK)’, *Cornea*, 21(1), pp. 95–100. doi: 10.1097/00003226-200201000-00020.



- Markoulli M, Papas E, Cole N, Holden BA. The diurnal variation of matrix metalloproteinase-9 and its associated factors in human tears. *Invest Ophthalmol Vis Sci.* 2012;53(3):1479-1484. Published 2012 Mar 21. doi:10.1167/iovs.11-8365
- Mazzotta, C., Balestrazzi, A., Baiocchi, S., Traversi, C. dan Caporossi, A. 2007. “Stromal haze after combined riboflavin-UVA corneal collagen cross-linking in keratoconus: in vivo confocal microscopic evaluation,” *Clin. Experiment. Ophthalmol.*, 35(6), hal. 580–582.
- McMonnies, C. W. 2007. “Abnormal rubbing and keratectasia,” in *Eye Contact Lens*, hal. 265–271.
- Melchiori A, Albini A, Ray JM et al. Inhibition of tumor cell invasion by a highly conserved peptide sequence from the matrix metalloproteinase enzyme prosegment. *Cancer Res* 1992; 52: 2353–6.
- Mohammadi, S.-F., Tahvildari, M., & Z-Mehrjardi, H. (2012). Physiology of Astigmatism. *Astigmatism - Optics, Physiology and Management*. doi:10.5772/1806810.5772/18068
- Mohamed-Noriega K, Butrón-Valdez K, Vazquez-Galvan J, Mohamed-Noriega J, Cavazos-Adame H, Mohamed-Hamsho J. Corneal Melting after Collagen Cross-Linking for Keratoconus in a Thin Cornea of a Diabetic Patient Treated with Topical Nepafenac: A Case Report with a Literature Review. *Case Rep Ophthalmol.* 2016 Feb 26;7(1):119-24. doi: 10.1159/000444437. PMID: 27293413; PMCID: PMC4899655.
- Nichamin, L. D. (2006) ‘Astigmatism Control’, 19, pp. 485–493. doi: 10.1016/j.ohc.2006.07.004.
- Ostadimoghaddam H, Fotouhi A, Hashemi H, Yekta A, Heravian J, Rezvan F, et al. Prevalence of the refractive errors by age and gender in Mashhad, Iran: The Mashhad eye study. *Clin Experiment Ophthalmol* 2011;39:743–51

- Pang, X., Peng, X., Fan, Z., Jia, H. dan Wu, T. 2016. “Comparison of Central 68 Corneal Thickness using Ultrasound Pachymetry during Corneal Collagen Cross-linking,” *眼科学报*, 28(1), hal. 15–19.
- Park, S. (2018) ‘Collagen cross-linking for pediatric refractive correction’, *Ann E. Sci*, 3, pp. 59–59. doi: 10.21037/aes.2018.12.02 .
- Paterson CA, Wells JG, Koklitis PA, Higgs GA, Docherty AJP. Recombinant tissue inhibitor of metalloproteinases type I suppresses alkali burninduced corneal ulceration in rabbits. *Invest Ophthalmol Vis Sci* 1994;35:677-84..
- Press, D. (2018) ‘Comparative analysis of safety and efficacy of photorefractive keratectomy versus photorefractive keratectomy combined with crosslinking’, pp. 783–790.
- Raiskup-Wolf F, Hoyer A, Spoerl E, Pillunat LE. Colla-gen crosslinking with riboflavin and ultraviolet-A light inkeratoconus: long-term results. *J Cataract Refract Surg*.2008;34:796---801
- Read SA, Collins MJ, Carney LG. A review of astigmatism and its possible genesis. *Clin Exp Optom*. 2007 Jan;90(1):5-19. doi: 10.1111/j.1444-0938.2007.00112.x. PMID: 17177660.
- Read, S. A., Collins, M. J. and Carney, L. G. (2007) ‘The influence of eyelid morphology on normal corneal shape’, *Investig. Ophthalmol. Vis. Sci*, 48(1), pp. 112–119. doi:10.1167/iovs.06-0675.
- Rossi S, Orrico A, Santamaria C, Romano V, De Rosa L, Simonelli F, De Rosa G. Standard versus trans-epithelial collagen cross-linking in keratoconus patients suitable for standard collagen cross-linking. *Clin Ophthalmol* 2015; 9:503–509
- Read, S. A., Vincent, S. J. and Collins, M. J. (2014) ‘The visual and functional impacts of astigmatism and its clinical management’, 34, pp. 267–294. doi: 10.1111/opo.12128.



Ruberti, J. W., Sinha Roy, A. and Roberts, C. J. (2011) ‘Corneal Structure and Function’, *Annual Review of Biomedical Engineering*, 13(1), pp. 269–295. doi: 10.1146/annurev-bioeng-070909-105243.

Sachdev, G. S., Ramamurthy, S., Gitansha Sachdev dan Shreyas Ramamurthy 2018. “Clinical presentation following photorefractive intrastromal crosslinking for myopic correction,” *Indian J. Ophthalmol.* Wolters Kluwer -- Medknow Publications, 66(7), hal. 993–994.

Samaras, K. E. and Lake, D. B. (2010) ‘Corneal Collagen Cross Linking (CXL): A Review’, 50(3), pp. 89–100.

Saw SM, Chan YH, Wong WL, Shankar A, Sandar M, Aung T, et al. Prevalence and risk factors for refractive errors in the Singapore Malay Eye Survey. *Ophthalmology* 2008;115:1713–9.

Schmidinger G, Pachala M, Prager F. Pachymetry changes during corneal crosslinking effect of closed eyelids and hypotonic riboflavin solution. *J Cataract Refract Surg.* 2013 Aug;39(8):1179–83. doi: 10.1016/j.jcrs.2013.03.021. Epub 2013 Jun 21. PMID: 23796621.

Semchishen, A., Mrochen, M. dan Semchishen, V. 2015. “Model for Optimization of the UV-A/Riboflavin Strengthening (cross-linking) of the Cornea: Percolation Threshold,” *Photochem. Photobiol.* Wiley/Blackwell (10.1111), 91(6), hal. 1403–1411

Seven, I., Roy, A. S. and Jr, W. J. D. (2014) ‘Patterned corneal collagen crosslinking for astigmatism : Computational modeling study’, *J. Cataract Refract Surg.* ASCRS and ESCRS, pp. 1–11. doi: 10.1016/j.jcrs.2014.03.019.

Sharif R, Fowler B, Karamichos D. Collagen cross-linking impact on keratoconus extracellular matrix. *PLoS One.* 2018;13(7):e0200704. Published 2018 Jul 18. doi:10.1371/journal.pone.0200704



- Sharma A, Nottage JM, Mirchia K, Sharma R, Mohan K, Nirankari VS. Persistent corneal edema after collagen cross-linking for keratoconus. *Am J Ophthalmol.* 2012;154(6):922-926.e1. doi:10.1016/j.ajo.2012.06.005
- Shelton L, Rada JS. Effects of cyclic mechanical stretch on extracellular matrix synthesis by human scleral fibroblasts. *Exp Eye Res.* 2007; 84:314 -322.
- Shen M, Fan F, Xue A, Wang J, Zhou X, Lu F. Biomechanical properties of the cornea in high myopia. *Vision Res.* 2008 Sep;48(21):2167-71. doi: 10.1016/j.visres.2008.06.020. Epub 2008 Aug 3. PMID: 18638498.
- Siegwart JT Jr, Norton TT. Steady state mRNA levels in tree shrew sclera with form deprivation myopia and during recovery. *Invest Ophthalmol Vis Sci.* 2001; 42:1153-1159
- Story, C. (2009) ‘CXL Indications’, (April), pp. 33–35.
- Tahzib NG, Soetern N, Van der Lelij A. Pachymetry during cross-linking. *Ophthalmology* 2010;117(10):2041.
- Theuring, A., Spoerl, E., Pillunat, L. E. dan Raisskup, F. 2015. “[Corneal collagen cross-linking with riboflavin and ultraviolet-A light in progressive keratoconus. Results after 10-year follow-up],” *Ophthalmologe*, 112(2), hal.140–7.
- Toprak I, Yaylali V, Yildirim C. Visual, Topographic, and Pachymetric Effects of Pediatric Corneal Collagen Cross-linking. *J Pediatr Ophthalmol Strabismus.* 2017;54(2):84-89. doi:10.3928/01913913-20160831-01
- Van der Rest M, Garrone R. Collagen family of proteins. *FASEB J* 1991; 5:2814-2823.
- Varma, R. *Et al.* (2017) ‘Prevalence and Risk Factors for Refractive Error in Adult Chinese Americans: The Chinese American Eye Study’, *Am J Ophthalmol*, 175, pp. 201– 212. doi: 10.1016/j.ajo.2016.10.002.

Vinciguerra, P. (2009). *Intraoperative and Postoperative Effects of Corneal Collagen Cross-linking on Progressive Keratoconus. Archives of Ophthalmology, 127(10), 1258*

Willard HF, Durfy SJ, Mahtani MM et al. Regional localization of the TIMP gene on the human X chromosome. Extension of a conserved synteny and linkage group on proximal Xp. *Hum Genet* 1989; 81: 234–8

Wittig-Silva C, Chan E, Islam FM, Wu T, Whiting M, Snibson GR. A randomized, controlled trial of corneal collagen cross-linking in progressive keratoconus: three-year results. *Ophthalmology*. 2014;121(4):812-821. doi:10.1016/j.ophtha.2013.10.028

Woessner JF. Metalloproteinase and their inhibitors in connective tissue remodelling. *FASEB J* 1991;5: 2145-54.

Wolfram C, HoÈhn R, Kottler U, Wild P, Blettner M, BuÈhren J, et al. Prevalence of refractive errors in the European adult population: the Gutenberg Health Study (GHS). *Br J Ophthalmol*. 2014; 98(7): 857±861. <https://doi.org/10.1136/bjophthalmol-2013-304228> PMID: 24515986.

Wolffsohn JS, Bhogal G & Shah S. Effect of uncorrected astigmatism on vision. *J Cataract Refract Surg* 2011; 37: 454–460

Wollensak G, Seiler T, Wilsch M, SpoÈrl E. Collagen fiber diameter after riboflavin/UVA induced collagen-crosslinking in the rabbit cornea. *Cornea*. Forthcoming. 2004.

Wood JM, Tyrrell RA, Chaparro A, Marszalek RP, Carberry TP & Chu BS. Even moderate visual impairments degrade effects of induced oblique astigmatism on symptoms and reading performance while viewing a computer screen. *Ophthalmic Physiol Opt* 2012; 32: 142–148.



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Perubahan Kadar Tissue Inhibitor Metalloproteinase-1 pada Pasien Astigmatisme Ringan-Sedang Sebelum

dan Setelah Dilakukan Terapi Collagen Cross-Linking Kornea

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Xu X, Liu T, Li H. Effect of Collagen Cross-Linking on Alkali Burn-Induced Corneal Neovascularization in Rabbits. *J Ophthalmol.*

2018;2018:7325483. Published 2018 Oct 9. doi:10.1155/2018/7325483

Xue ML, Wakefield D, Willcox MD, Lloyd AR, Di Girolamo N, Cole N, Thakur A. Regulation of MMPs and TIMPs by IL-1 β during corneal ulceration and infection. *Invest Ophthalmol Vis Sci.* 2003 May;44(5):2020-5. doi: 10.1167/iovs.02-0565. PMID: 12714639.

Yan Jia et al. MMP-2, MMP-3, TIMP-1, TIMP-2 and TIMP-3 Protein Level in Human Aqueous Humor: Relationship with Axial Length. 2014. Manuscript IOVS. 114-13983.

Yari D, Ehsanbakhsh Z, Validad MH, Langroudi FH. Association of *TIMP-1* and *COL4A4* Gene Polymorphisms with Keratoconus in an Iranian Population. *J Ophthalmic Vis Res.* 2020 Aug 6;15(3):299-307. doi: 10.18502/jovr.v15i3.7448. PMID: 32864060; PMCID: PMC7431712.