

**Ausgabe:** Prophylaxe Journal 1/2019

**Thema:** Der Einsatz von Melatonin in der Parodontologie

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## Literatur

- 1 Page, R. C., & Kornman, K. S. (1997). The pathogenesis of human periodontitis: an introduction. *Periodontology 2000*, 14(1), 9-11.
- 2 Meyle, J., & Chapple, I. (2015). Molecular aspects of the pathogenesis of periodontitis. *Periodontology 2000*, 69(1), 7-17.
- 3 Liu, C., Mo, L., Niu, Y., Li, X., Zhou, X., & Xu, X. (2017). The role of reactive oxygen species and autophagy in periodontitis and their potential linkage. *Frontiers in physiology*, 8, 439.
- 4 Consensus Conference Panel, Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., ... & Kushida, C. (2015). Joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society on the recommended amount of sleep for a healthy adult: methodology and discussion. *Sleep*, 38(8), 1161-1183.
- 5 Ford, E. S., Li, C., Wheaton, A. G., Chapman, D. P., Perry, G. S., & Croft, J. B. (2014). Sleep duration and body mass index and waist circumference among US adults. *Obesity*, 22(2), 598-607.
- 6 Ford, E. S., Cunningham, T. J., & Croft, J. B. (2015a). Trends in self-reported sleep duration among US adults from 1985 to 2012. *Sleep*, 38(5), 829-832.
- 7 Ford, E. S., Cunningham, T. J., Giles, W. H., & Croft, J. B. (2015b). Trends in insomnia and excessive daytime sleepiness among US adults from 2002 to 2012. *Sleep medicine*, 16(3), 372-378.
- 8 Everson, C. A., Bergmann, B. M., & Rechtschaffen, A. (1989). Sleep deprivation in the rat: III. Total sleep deprivation. *Sleep*, 12(1), 13-21.
- 9 Spiegel, K., Leproult, R., & Van Cauter, E. (1999). Impact of sleep debt on metabolic and endocrine function. *The lancet*, 354(9188), 1435-1439.
- 10 Del Gallo, F., Opp, M., & Rlmeri, L. (2014). The reciprocal link between sleep and immune responses. *Arch Ital Biol*, 152, 93-102.
- 11 Marshall, L., & Born, J. (2002). Brain-immune interactions in sleep. *International review of neurobiology*, 52, 93-131.
- 12 Prather, A. A., Janicki-Deverts, D., Hall, M. H., & Cohen, S. (2015). Behaviorally assessed sleep and susceptibility to the common cold. *Sleep*, 38(9), 1353-1359.
- 13 Dawson, D., & Armstrong, S. M. (1996). Chronobiotics—drugs that shift rhythms. *Pharmacology & therapeutics*, 69(1), 15-36.
- 14 Lerner, A. B., Case, J. D., Mori, W., & Wright, M. R. (1959). Melatonin in peripheral nerve. *Nature*, 183(4678), 1821.

- 15 Gómez-Moreno, G., Cutando-Soriano, A., Arana, C., Galindo, P., Bolaños, J., Acuña-Castroviejo, D., & Wang, H. L. (2007). Melatonin expression in periodontal disease. *Journal of Periodontal Research*, 42(6), 536-540.
- 16 De Berardis, D., Marini, S., Fornaro, M., Srinivasan, V., Iasevoli, F., Tomasetti, C., ... & di Giannantonio, M. (2013). The melatonergic system in mood and anxiety disorders and the role of agomelatine: implications for clinical practice. *International journal of molecular sciences*, 14(6), 12458-12483.
- 17 Acuña-Castroviejo, D., Escames, G., Venegas, C., Díaz-Casado, M. E., Lima-Cabello, E., López, L. C., ... & Reiter, R. J. (2014). Extrapineal melatonin: sources, regulation, and potential functions. *Cellular and molecular life sciences*, 71(16), 2997-3025.
- 18 Slominski, R. M., Reiter, R. J., Schlabritz-Loutsevitch, N., Ostrom, R. S., & Slominski, A. T. (2012). Melatonin membrane receptors in peripheral tissues: distribution and functions. *Molecular and cellular endocrinology*, 351(2), 152-166.
- 19 Pandi-Perumal, S. R., Trakht, I., Srinivasan, V., Spence, D. W., Maestroni, G. J., Zisapel, N., & Cardinali, D. P. (2008). Physiological effects of melatonin: role of melatonin receptors and signal transduction pathways. *Progress in neurobiology*, 85(3), 335-353.
- 20 Chan, K., & Wong, Y. (2013). A molecular and chemical perspective in defining melatonin receptor subtype selectivity. *International journal of molecular sciences*, 14(9), 18385-18406.
- 21 Carpentieri, A. R., Lopez, M. E. P., Aguilar, J., & Solá, V. M. (2017). Melatonin and periodontal tissues: Molecular and clinical perspectives. *Pharmacological research*, 125, 224-231.
- 22 Carpentieri, A. R., Oliva, C., Díez-Noguera, A., & Cambras, T. (2015). Melatonin administration modifies circadian motor activity under constant light depending on the lighting conditions during suckling. *Chronobiology international*, 32(7), 994-1004.
- 23 Touitou, Y., Reinberg, A., & Touitou, D. (2017). Association between light at night, melatonin secretion, sleep deprivation, and the internal clock: Health impacts and mechanisms of circadian disruption. *Life sciences*, 173, 94-106.
- 24 Cutando, A., Galindo, P., Gómez-Moreno, G., Arana, C., Bolanos, J., Acuña-Castroviejo, D., & Wang, H. L. (2006). Relationship between salivary melatonin and severity of periodontal disease. *Journal of periodontology*, 77(9), 1533-1538.
- 25 Laakso, M. L., Porkka-Heiskanen, T., Alila, A., Stenberg, D., & Johansson, G. (1990). Correlation between salivary and serum melatonin: dependence on serum melatonin levels. *Journal of pineal research*, 9(1), 39-50.
- 26 Reiter, R. J., Rosales-Corral, S. A., Liu, X. Y., Acuna-Castroviejo, D., Escames, G., & Tan, D. X. (2015). Melatonin in the oral cavity: physiological and pathological implications. *Journal of periodontal research*, 50(1), 9-17.
- 27 Shimosuma, M., Tokuyama, R., Tatehara, S., Umeki, H., Ide, S., Mishima, K., ... & Satomura, K. (2011). Expression and cellular localization of melatonin-synthesizing enzymes in rat and human salivary glands. *Histochemistry and cell biology*, 135(4), 389-396.

- 28 Kopáni, M., Celec, P., Danišovič, L., Michalka, P., & Biró, C. (2006). Oxidative stress and electron spin resonance. *Clinica chimica acta*, 364(1-2), 61-66.
- 29 Celec, P. (2017). Oxidative Stress and Antioxidants in the Diagnosis and Therapy of Periodontitis. *Frontiers in physiology*, 8, 1055.
- 30 Chapple, I. L. (1996). Role of free radicals and antioxidants in the pathogenesis of the inflammatory periodontal diseases. *Clinical Molecular Pathology*, 49(5), M247.
- 31 Chapple, I. L., Milward, M. R., & Dietrich, T. (2007). The prevalence of inflammatory periodontitis is negatively associated with serum antioxidant concentrations. *The Journal of nutrition*, 137(3), 657-664.
- 32 Ahmadi-Motamayel, F., Goodarzi, M. T., Jamshidi, Z., & Kebriaei, R. (2017). Evaluation of salivary and serum antioxidant and oxidative stress statuses in patients with chronic periodontitis: a case-control study. *Frontiers in physiology*, 8, 189
- 33 Niki, E. (2016). Oxidative stress and antioxidants: Distress or eustress? *Archives of biochemistry and biophysics*, 595, 19-24.
- 34 Reiter, R. J., Mayo, J. C., Tan, D. X., Sainz, R. M., Alatorre-Jimenez, M., & Qin, L. (2016). Melatonin as an antioxidant: under promises but over delivers. *Journal of pineal research*, 61(3), 253-278.
- 35 Majidinia, M., Sadeghpour, A., Mehrzadi, S., Reiter, R. J., Khatami, N., & Yousefi, B. (2017). Melatonin: A pleiotropic molecule that modulates DNA damage response and repair pathways. *Journal of pineal research*, 63(1), e12416.
- 36 Sharafati-Chaleshtori, R., Shirzad, H., Rafieian-Kopaei, M., & Soltani, A. (2017). Melatonin and human mitochondrial diseases. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*, 22.
- 37 Nakamura, E., Kozaki, K. I., Tsuda, H., Suzuki, E., Pimkhaokham, A., Yamamoto, G., ... & Imoto, I. (2008). Frequent silencing of a putative tumor suppressor gene melatonin receptor 1 A (MTNR1A) in oral squamous-cell carcinoma. *Cancer science*, 99(7), 1390-1400.
- 38 Gómez-Florit, M., Ramis, J. M., & Monjo, M. (2013). Anti-fibrotic and anti-inflammatory properties of melatonin on human gingival fibroblasts in vitro. *Biochemical pharmacology*, 86(12), 1784-1790.
- 39 Cutando, A., Montero, J., Gómez-de Diego, R., Ferrera, M. J., & Lopez-Valverde, A. (2015). Effect of topical application of melatonin on serum levels of C-reactive protein (CRP), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- $\alpha$ ) in patients with type 1 or type 2 diabetes and periodontal disease. *Journal of clinical and experimental dentistry*, 7(5), e628-e633.
- 40 Cutando, A., López-Valverde, A., de Diego, R. G., de Vicente, J., Reiter, R., Fernández, M. H., & Ferrera, M. J. (2014). Effect of topical application of melatonin to the gingiva on salivary osteoprotegerin, RANKL and melatonin levels in patients with diabetes and periodontal disease. *Odontology*, 102(2), 290-296.
- 41 Murakami, Y., Machino, M., & Fujisawa, S. (2012). Porphyromonas gingivalis fimbria-induced expression of inflammatory cytokines and cyclooxygenase-2 in mouse macrophages

and its inhibition by the bioactive compounds fibronectin and melatonin. *ISRN dentistry*, 2012.

42 Esteban, S., Nicolaus, C., Garmundi, A., Rial, R. V., Rodríguez, A. B., Ortega, E., & Ibars, C. B. (2004). Effect of orally administered L-tryptophan on serotonin, melatonin, and the innate immune response in the rat. *Molecular and cellular biochemistry*, 267(1-2), 39-46.

43 Almughrabi, O. M., Marzouk, K. M., Hasanato, R. M., & Shafik, S. S. (2013). Melatonin levels in periodontal health and disease. *Journal of periodontal research*, 48(3), 315-321.

44, R., Acharya, A. B., & Thakur, S. L. (2010). Salivary and gingival crevicular fluid melatonin in periodontal health and disease. *Journal of periodontology*, 81(2), 277-283.

45 Bertl, K., Schoiber, A., Haririan, H., Laky, M., Steiner, I., Rausch, W. D., ... & Rausch-Fan, X. (2013). Non-surgical periodontal therapy influences salivary melatonin levels. *Clinical oral investigations*, 17(4), 1219-1225.

46 Lodhi, K., Saimbi, C. S., Khan, M. A., Nath, C., & Shukla, R. (2016). Evaluation of melatonin levels in saliva in gingivitis and periodontitis cases: A pilot study. *Contemporary clinical dentistry*, 7(4), 519.

47 Balaji, T. M., Vasanthi, H. R., & Rao, S. R. (2015). Gingival, plasma and salivary levels of melatonin in periodontally healthy individuals and chronic periodontitis patients: a pilot study. *Journal of clinical and diagnostic research: JCDR*, 9(3), ZC23.

48 Kara, A., Akman, S., Ozkanlar, S., Tozoglu, U., Kalkan, Y., Canakci, C. F., & Tozoglu, S. (2013). Immune modulatory and antioxidant effects of melatonin in experimental periodontitis in rats. *Free Radical Biology and Medicine*, 55, 21-26.

49 Özdem, M., Kirzioğlu, F. Y., Yılmaz, H. R., Vural, H., Fentoğlu, Ö., Uz, E., ... & Yiğit, A. (2017). Antioxidant effects of melatonin in heart tissue after induction of experimental periodontitis in rats. *Journal of oral science*, 59(1), 23-29.

50 Arabacı, T., Kermen, E., Özkanlar, S., Köse, O., Kara, A., Kızıldağ, A., ... & Ibişoğlu, E. (2015). Therapeutic effects of melatonin on alveolar bone resorption after experimental periodontitis in rats: A biochemical and immunohistochemical study. *Journal of periodontology*, 86(7), 874-881.

51 Renn, T. Y., Huang, Y. K., Feng, S. W., Wang, H. W., Lee, W. F., Lin, C. T., ... & Chang, H. M. (2018). Prophylactic supplement with melatonin successfully suppresses the pathogenesis of periodontitis through normalizing RANKL/OPG ratio and depressing the TLR 4/MyD88 signaling pathway. *Journal of pineal research*, 64(3), e12464.

52 Proksch, S., Strobel, S. L., Vach, K., Abouassi, T., Tomakidi, P., Ratka-Krüger, P., & Hellwig, E. (2014). Melatonin as a Candidate Therapeutic Drug for Protecting Bone Cells From Chlorhexidine-Induced Damage. *Journal of periodontology*, 85(12), e379-e389.

53 Rodríguez-Lozano, F. J., García-Bernal, D., de los Ángeles Ros-Roca, M., del Carmen Algueró, M., Oñate-Sánchez, R. E., Camacho-Alonso, F., & Moraleda, J. M. (2015). Cytoprotective effects of melatonin on zoledronic acid-treated human mesenchymal stem cells in vitro. *Journal of Cranio-Maxillofacial Surgery*, 43(6), 855-862.

- 54 Virto, L., Cano, P., Jiménez-Ortega, V., Fernández-Mateos, P., González, J., Esquifino, A. I., & Sanz, M. (2018b). Obesity and periodontitis: An experimental study to evaluate periodontal and systemic effects of comorbidity. *Journal of periodontology*, 89(2), 176-185.
- 55 Virto, L., Haugen, H. J., Fernández-Mateos, P., Cano, P., González, J., Jiménez-Ortega, V., & Sanz Alonso, M. (2018c). Melatonin expression in periodontitis and obesity: An experimental in-vivo investigation. *Journal of Periodontal Research*, 53(5), 825-831.
- 56 Virto, L., Cano, P., Jiménez-Ortega, V., Fernández-Mateos, P., González, J., Haugen, H. J., ... & Sanz, M. (2018a). Melatonin as adjunctive therapy in the treatment of periodontitis associated with obesity. *Journal of clinical periodontology*, 45(11), 1336-1346.
- 57 Balci Yuce, H., Karatas, O., Aydemir Turkal, H., Pirim Gorgun, E., Ocakli, S., Benli, I., & Cayli, S. (2016). The Effect of Melatonin on Bone Loss, Diabetic Control, and Apoptosis in Rats With Diabetes With Ligature-Induced Periodontitis. *Journal of periodontology*, 87(4), e35-e43.
- 58 Köse, O., Arabaci, T., Kara, A., Yemenoglu, H., Kermen, E., Kizildag, A., ... & Ozkanlar, S. (2016). Effects of melatonin on oxidative stress index and alveolar bone loss in diabetic rats with periodontitis. *Journal of periodontology*, 87(5), e82-e90
- 59 Taylor, J. J., Preshaw, P. M., & Lalla, E. (2013). A review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. *Journal of Periodontology*, 84(4-s), S113-S134.
- 60 Abdolsamadi, H., Goodarzi, M. T., Motemayel, F. A., Jazaeri, M., Feradmal, J., Zarabadi, M., ... & Torkzaban, P. (2014). Reduction of melatonin level in patients with type II diabetes and periodontal diseases. *Journal of dental research, dental clinics, dental prospects*, 8(3), 160.
- 61 Cutando, A., López-Valverde, A., Gómez-de-Diego, R., Arias-Santiago, S., & de Vicente-Jiménez, J. (2013). Effect of gingival application of melatonin on alkaline and acid phosphatase, osteopontin and osteocalcin in patients with diabetes and periodontal disease. *Medicina oral, patología oral y cirugía bucal*, 18(4), e657-e663.
- 62 Montero, J., López-Valverde, N., Ferrera, M. J., & López-Valverde, A. (2017). Changes in crevicular cytokines after application of melatonin in patients with periodontal disease. *Journal of clinical and experimental dentistry*, 9(9), e1081-1087.
- 63 Chitsazi, M., Faramarzie, M., Sadighi, M., Shirmohammadi, A., & Hashemzadeh, A. (2017). Effects of adjective use of melatonin and vitamin C in the treatment of chronic periodontitis: A randomized clinical trial. *Journal of dental research, dental clinics, dental prospects*, 11(4), 236
- 64 El-Sharkawy, H., Elmeadawy, S., Elshinnawi, U., & Anees, M. (2018). Is dietary melatonin supplementation a viable adjunctive therapy for chronic periodontitis?—A randomized controlled clinical trial. *Journal of periodontal research*. [Epub ahead of print]
- 65 Bazyar, H., Gholinezhad, H., Moradi, L., Salehi, P., Abadi, F., Ravanbakhsh, M., & Javid, A. Z. (2018). The effects of melatonin supplementation in adjunct with non-surgical periodontal therapy on periodontal status, serum melatonin and inflammatory markers in type

2 diabetes mellitus patients with chronic periodontitis: a double-blind, placebo-controlled trial. *Inflammopharmacology*. [Epub ahead of print]

66 Karaaslan, C., & Suzen, S. (2015). Antioxidant properties of melatonin and its potential action in diseases. *Current topics in medicinal chemistry*, 15(9), 894-903.

67 Cipolla-Neto, J., Amaral, F. G., Afeche, S. C., Tan, D. X., & Reiter, R. J. (2014). Melatonin, energy metabolism, and obesity: a review. *Journal of pineal research*, 56(4), 371-381.

68 Hahner, P., Gaßmann, G. (2016). Ernährung und Parodontitis – ein Review. *PLAQUE N CARE Prophylaxe-Parodontologie-Ästhetik*, 10 (2): 58-63.

69 Najeeb, S., Khurshid, Z., Zohaib, S., & Zafar, M. S. (2016). Therapeutic potential of melatonin in oral medicine and periodontology. *The Kaohsiung journal of medical sciences*, 32(8), 391-396.

70 Andersen, L. P. H., Gögenur, I., Rosenberg, J., & Reiter, R. J. (2016). The safety of melatonin in humans. *Clinical drug investigation*, 36(3), 169-175.