



Karies meets Pulpa

# Karies meets Pulpa Wie weit kann man gehen?

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## Literaturangabe

- Institut der Deutschen Zahnärzte. Fünfte Deutsche Mundgesundheitsstudie (DMS V). Köln; 2016.
- Yu C, Abbott PV. An overview of the dental pulp: its functions and responses to injury. *Aust Dent J* 2007; 52(1 Suppl):S4-16. doi: 10.1111/j.1834-7819.2007.tb00525.x.
- Caplan DJ, Cai J, Yin G, White BA. Root canal filled versus non-root canal filled teeth: a retrospective comparison of survival times. *J Public Health Dent* 2005; 65(2):90-6. doi: 10.1111/j.1752-7325.2005.tb02792.x.
- Lertchirakarn V, Palamara JEA, Messer HH. Patterns of vertical root fracture: factors affecting stress distribution in the root canal. *J Endod* 2003; 29(8):523-8. doi: 10.1097/00004770-200308000-00008.
- Widbillier M, Eidt A, Lindner SR, Hiller K-A, Schweikl H, Buchalla W et al. Dentine matrix proteins: isolation and effects on human pulp cells. *Int Endod J* 2018; 51 Suppl 4:e278-e290. doi: 10.1111/iej.12754.
- Widbillier M, Schmalz G. Endodontic regeneration: hard shell, soft core. *Odontology* 2020. doi: 10.1007/s10266-020-00573-1.
- Fosse G, Saele PK, Eide R. Numerical density and distributional pattern of dentin tubules. *Acta Odontol Scand* 1992; 50(4):201-10. doi: 10.3109/00016359209012764.
- Bleicher F. Odontoblast physiology. *Exp Cell Res* 2014; 325(2):65-71. doi: 10.1016/j.yexcr.2013.12.012.
- Wolters WJ, Duncan HF, Tomson PL, Karim IE, McKenna G, Dorri M et al. Minimally invasive endodontics: a new diagnostic system for assessing pulpitis and subsequent treatment needs. *Int Endod J* 2017; 50(9):825-9. doi: 10.1111/iej.12793.
- Widbillier M, Galler K. Zahnpulpa: Vitalerhaltung bis Regeneration. *Zahnmedizin update* 2018; 12(01):23-41. doi: 10.1055/s-0043-121604.
- Selwitz RH, Ismail AI, Pitts NB. Dental caries. *Lancet* 2007; 369(9555):51-9. doi: 10.1016/S0140-6736(07)60031-2.
- Gustafsson BE. The Vipeholm dental caries study: survey of the literature on carbohydrates and dental caries. *Acta Odontol Scand* 1954; 11(3-4):207-31. doi: 10.3109/00016355308993924.
- Forssten SD, Björklund M, Ouwehand AC. Streptococcus mutans, caries and simulation models. *Nutrients* 2010; 2(3):290-8. doi: 10.3390/nu2030290.
- Schwendicke F, Frencken JE, Bjørndal L, Maltz M, Manton DJ, Ricketts D et al. Managing Carious Lesions: Consensus Recommendations on Carious Tissue Removal. *Adv Dent Res* 2016; 28(2):58-67. doi: 10.1177/0022034516639271.
- Hilton TJ. Keys to clinical success with pulp capping: a review of the literature. *Oper Dent* 2009; 34(5):615-25. doi: 10.2341/09-132-0.
- Dammaschke T, Galler K, Krastl G. Wissenschaftliche Stellungnahme: Aktuelle Empfehlungen zur Vitalerhaltung der Pulpa: Deutsche Gesellschaft für Endodontologie und zahnärztliche Traumatologie. *Deutsche Zahnärztliche Zeitschrift* 2019.
- Buchalla W, Frankenberger R, Galler K. Aktuelle Empfehlungen zur Kariesexkavation: Wissenschaftliche Mitteilung der Deutschen Gesellschaft für Zahnerhaltung (DGZ). *Deutsche Zahnärztliche Zeitschrift* 2017; (72 (6)).
- Scholz KJ, Hinderberger M, Widbillier M, Federlin M, Hiller K-A, Buchalla W. Influence of selective caries excavation on marginal penetration of class II composite restorations in vitro. *Eur J Oral Sci* 2020. doi: 10.1111/eos.12726.
- Isolan CP, Sarkis-Onofre R, Lima GS, Moraes RR. Bonding to Sound and Caries-Affected Dentin: A Systematic Review and Meta-Analysis. *J Adhes Dent* 2018; 20(1):7-18. doi: 10.3290/j.jad.a39775.
- Schwendicke F, Kern M, Blunck U, Dörfer C, Drenck J, Paris S. Marginal integrity and secondary caries of selectively excavated teeth in vitro. *J Dent* 2014; 42(10):1261-8. doi: 10.1016/j.jdent.2014.08.002.
- Sahin N, Saygili S, Akcay M. Clinical, radiographic, and histological evaluation of three different pulp-capping materials in indirect pulp treatment of primary teeth: a randomized clinical trial. *Clin Oral Investig* 2021. doi: 10.1007/s00784-020-03724-4.
- Dammaschke T, Stratmann U, Fischer R-J, Sagheri D, Schäfer E. A histologic investigation of direct pulp capping in rodents with dentin adhesives and calcium hydroxide. *Quintessence Int* 2010; 41(4):e62-71.
- Bouillaguet S, Wataha JC, Hanks CT, Ciucchi B, Holz J. In vitro cytotoxicity and dentin permeability of HEMA. *J Endod* 1996; 22(5):244-8. doi: 10.1016/S0099-2399(06)80141-x.
- Krifka S, Seidenader C, Hiller K-A, Schmalz G, Schweikl H. Oxidative stress and cytotoxicity generated by dental composites in human pulp cells. *Clin Oral Investig* 2012; 16(1):215-24. doi: 10.1007/s00784-010-0508-5.

25. Schweikl H, Petzel C, Bolay C, Hiller K-A, Buchalla W, Krifka S. 2-Hydroxyethyl methacrylate-induced apoptosis through the ATM- and p53-dependent intrinsic mitochondrial pathway. *Biomaterials* 2014; 35(9):2890–904. doi: 10.1016/j.biomaterials.2013.12.044.
26. Leye Benoist F, Gaye Ndiaye F, Kane AW, Benoist HM, Farge P. Evaluation of mineral trioxide aggregate (MTA) versus calcium hydroxide cement (Dycal®) in the formation of a dentine bridge: a randomised controlled trial. *Int Dent J* 2012; 62(1):33–9. doi: 10.1111/j.1875-595X.2011.00084.x.
27. Petrou MA, Alhamoui FA, Welk A, Altarabulsi MB, Alkilzy M, H Splieth C. A randomized clinical trial on the use of medical Portland cement, MTA and calcium hydroxide in indirect pulp treatment. *Clin Oral Investig* 2014; 18(5):1383–9. doi: 10.1007/s00784-013-1107-z.
28. Boddeda KR, Rani CR, V Vanga NR, Chandrabhatla SK. Comparative evaluation of biodentine, 2% chlorhexidine with RMGIC and calcium hydroxide as indirect pulp capping materials in primary molars: An in vivo study. *J Indian Soc Pedod Prev Dent* 2019; 37(1):60–6. doi: 10.4103/JISPPD.JISPPD\_213\_17.
29. Koc Vural U, Kiremitci A, Gokalp S. Randomized Clinical Trial to Evaluate MTA Indirect Pulp Capping in Deep Caries Lesions After 24-Months. *Oper Dent* 2017; 42(5):470–7. doi: 10.2341/16-110-C.
30. Mathur VP, Dhillon JK, Logani A, Kalra G. Evaluation of indirect pulp capping using three different materials: A randomized control trial using cone-beam computed tomography. *Indian J Dent Res* 2016; 27(6):623–9. doi: 10.4103/0970-9290.199588.
31. Marchi JJ, Araujo FB de, Fröner AM, Straffon LH, Nör JE. Indirect pulp capping in the primary dentition: a 4 year follow-up study. *J Clin Pediatr Dent* 2006; 31(2):68–71. doi: 10.17796/jcpd.31.2.y4um5076341226m5.
32. Farges J-C, Alliot-Licht B, Renard E, Ducret M, Gaudin A, Smith AJ et al. Dental Pulp Defence and Repair Mechanisms in Dental Caries. *Mediators Inflamm* 2015; 2015:230251. doi: 10.1155/2015/230251.
33. Hashem D, Mannocci F, Patel S, Manoharan A, Brown JE, Watson TF et al. Clinical and radiographic assessment of the efficacy of calcium silicate indirect pulp capping: a randomized controlled clinical trial. *J Dent Res* 2015; 94(4):562–8. doi: 10.1177/0022034515571415.
34. Kunert M, Lukomska-Szymanska M. Bio-Inductive Materials in Direct and Indirect Pulp Capping-A Review Article. *Materials (Basel)* 2020; 13(5). doi: 10.3390/ma13051204.
35. Garrocho-Rangel A, Quintana-Guevara K, Vázquez-Viera R, Arvizu-Rivera JM, Flores-Reyes H, Escobar-García DM et al. Bioactive Tricalcium Silicate-based Dentin Substitute as an Indirect Pulp Capping Material for Primary Teeth: A 12-month Follow-up. *Pediatr Dent* 2017; 39(5):377–82.
36. Widbiller M, Lindner SR, Buchalla W, Eidt A, Hiller K-A, Schmalz G et al. Three-dimensional culture of dental pulp stem cells in direct contact to tricalcium silicate cements. *Clin Oral Investig* 2016; 20(2):237–46. doi: 10.1007/s00784-015-1515-3.
37. Kaup M, Dammann CH, Schäfer E, Dammaschke T. Shear bond strength of Biodentine, ProRoot MTA, glass ionomer cement and composite resin on human dentine ex vivo. *Head Face Med* 2015; 11:14. doi: 10.1186/s13005-015-0071-z.
38. Berman, L, Hargreaves, K. *Cohen's Pathways of the Pulp*. 11. Aufl.: Elsevier; 2015.
39. Rajasekharan S, Martens LC, Cauwels RGEC, Anthonappa RP. Biodentine™ material characteristics and clinical applications: a 3 year literature review and update. *Eur Arch Paediatr Dent* 2018; 19(1):1–22. doi: 10.1007/s40368-018-0328-x.
40. Gallorini M, Krifka S, Widbiller M, Schröder A, Brochhausen C, Cataldi A et al. Distinguished properties of cells isolated from the dentin-pulp interface. *Ann Anat* 2020; 234:151628. doi: 10.1016/j.aanat.2020.151628.
41. Schmalz G, Hiller KA, Nunez LJ, Stoll J, Weis K. Permeability characteristics of bovine and human dentin under different pretreatment conditions. *J Endod* 2001; 27(1):23–30. doi: 10.1097/00004770-200101000-00007.