

## BÖLÜM 19

# PERİ-İMLANTİTİSİN ETİYOLOJİSİ, RİSK FAKTÖRLERİ VE RİSK GÖSTERGELERİNE GÜNCEL YAKLAŞIM

İlayda DEMİRCİOĞLU<sup>1</sup>

Dental implantlar, uygun protetik üstyapılarla çiğneme fonksiyonunun yeniden kazanılmasını ve alveoler kemik rezorpsiyonunun önlenmesini sağlayarak tam ve parsiyel dişsizlik tedavisinde günümüzde en çok tercih edilen yöntemlerden biri haline gelmiştir. 1978 yılında Brånemark'ın titanyum dental implantları geliştirmesiyle birlikte implantolojide önemli ilerlemeler kaydedilmiş; implant başarısını etkileyen biyolojik faktörlerin anlaşılması giderek daha fazla önem kazanmıştır (1,2).

Başlangıçta implant kaybı çoğunlukla mekanik faktörlere bağlanırken, güncel araştırmalar biyolojik ve mikrobiyal etkenlerin belirleyici rolünü ortaya koymuştur (1). Berglundh ve ark. (2018) tarafından yayımlanan uluslararası uzlaşma raporunda, peri-implant hastalıklar “peri-implant sağlık, peri-implant mukozitis, peri-implantitis ve peri-implant sert/yumuşak doku yetersizlikleri” olarak sınıflandırılmıştır (3). Mikrobiyal dental plak, periodontal hastalıklarda olduğu gibi peri-implant hastalıkların da temel etiyolojik faktördür (3).

Peri-implant mukozitis, gingivitisin implant çevresindeki karşılığı olup geri dönüşümlü enflamatuvar bir süreçtir. Klinik olarak sondalamada kanama ve/veya süpürasyon gözlenir, ancak patolojik kemik kaybı bulunmaz (3,5). Tedavi edilmediği takdirde peri-implant mukozitisin peri-implantitise dönüşme olasılığı yüksektir (5). Peri-implantitis ise peri-implant biyofilm ile ilişkili, ilerleyici kemik kaybı ve enflamasyonla karakterize patolojik bir durumdur (4).

Son yıllarda peri-implantitisin prevalansı artış göstermekte ve hastalar için hem klinik hem de ekonomik açıdan ciddi bir yük oluşturmaktadır (6). Tanı kriterlerindeki farklılıklar nedeniyle bildirilen oranlar değişmekle birlikte, implant

<sup>1</sup> Dt., Altınbaş Üniversitesi, Diş Hekimliği Fakültesi, Periodontoloji AD.,  
ilayda.demircioglu1@altinbas.edu.tr, 0009-0008-9491-8694

## KAYNAKLAR

1. Renvert S, Giovannoli JL. Peri-implantitis. Quintessence Publishing; 2012.
2. Pal T. Fundamentals and history of implant dentistry. Journal of the International Clinical Dental Research Organization. 2015;7(3):6.
3. Berglundh T, Armitage G, Araujo MG, et al. Peri-implant diseases and conditions: consensus report of workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. Journal of Clinical Periodontology. 2018;45(S20):S286–S291.
4. Heitz-Mayfield LJA, Salvi GE. Peri-implant mucositis. Journal of Clinical Periodontology. 2018;45(S20):S237–S245.
5. Herrera D, Berglundh T, Schwarz F, et al. Prevention and treatment of peri-implant diseases—The EFP S3 level clinical practice guideline. Journal of Clinical Periodontology. 2023;50(S26):4–76.
6. Obreja K, Ramanauskaite A, Begic A, et al. The prevalence of peri-implant diseases around subcrestally placed implants: a cross-sectional study. Clinical Oral Implants Research. 2021;32(6):702–710. doi:10.1111/CLR.13739
7. Mombelli A, Müller N, Cionca N. The epidemiology of peri-implantitis. Clinical Oral Implants Research. 2012;23(Suppl 6):67–76. doi:10.1111/j.1600-0501.2012.02541.x
8. Derks J, Tomasi C. Peri-implant health and disease: a systematic review of current epidemiology. Journal of Clinical Periodontology. 2015;42(Suppl 16):S158–S171. doi:10.1111/jcpe.12334
9. Diaz P, Gonzalo E, Villagra LJG, Miegimolle B, Suarez MJ. What is the prevalence of peri-implantitis? A systematic review and meta-analysis. BMC Oral Health. 2022;22(1):449. doi:10.1186/s12903-022-02493-8
10. Reis INRD, Huamán-Mendoza AA, Ramadan D, et al. The prevalence of peri-implant mucositis and peri-implantitis based on the World Workshop criteria: a systematic review and meta-analysis. Journal of Dentistry. 2025;160:105914. doi:10.1016/j.jdent.2025.105914
11. Gunpinar S, Meraci B, Karas M. Analysis of risk indicators for prevalence of peri-implant diseases in Turkish population. International Journal of Implant Dentistry. 2020;6:19. doi:10.1186/s40729-020-00215-9
12. Derks J, Schaller D, Håkansson J, Wennström JL, Tomasi C, Berglundh T. Peri-implantitis—onset and pattern of progression. Journal of Clinical Periodontology. 2016;43(4):383–388. doi:10.1111/jcpe.12535
13. Karlsson K, Derks J, Håkansson J, et al. Interventions for peri-implantitis and their effects on further bone loss: a retrospective analysis of a registry-based cohort. Journal of Clinical Periodontology. 2019;46:872–879.
14. Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. Journal of Clinical Periodontology. 2018;45(Suppl 20):S246–S266.
15. Donelli G, ed. Biofilm-based Healthcare-Associated Infections. Vol I. Advances in Experimental Medicine and Biology. Cham: Springer; 2015.
16. Salvi GE, Fürst MM, Lang NP, Persson GR. One-year bacterial colonization patterns of *Staphylococcus aureus* and other bacteria at implants and adjacent teeth. Clinical Oral Implants Research. 2008;19(3):242–248. doi:10.1111/j.1600-0501.2007.01470.x
17. Martínez-Hernández M, Reyes-Grajeda JP, Hannig M, et al. Salivary pellicle modulates biofilm formation on titanium surfaces. Clinical Oral Investigations. 2023;27:6135–6145.
18. Arciola CR, Campoccia D, Montanaro L. Implant infections: adhesion, biofilm formation and immune evasion. Nature Reviews Microbiology. 2018;16(7):397–409. doi:10.1038/s41579-018-0019-y
19. Fragkioudakis I, Tseleki G, Doufexi AE, Sakellari D. Current concepts on the pathogenesis of peri-implantitis: a narrative review. European Journal of Dentistry. 2021;15(3):476–487.
20. An YH, Dickinson RB, Doyle RJ. Mechanisms of bacterial adhesion and pathogenesis of implant and tissue infections. In: An YH, Friedman RJ, eds. Handbook of Bacterial Adhesion. Totowa (NJ): Humana Press; 2000. p. 1–27.

- 21.Montanaro L, Poggi A, Visai L, et al. Extracellular DNA in biofilms. *International Journal of Artificial Organs*. 2011;34(9):824–831. doi:10.5301/ijao.5000051
- 22.Sousa V, Mardas N, Spratt D, Boniface D, Dard M, Donos N. Experimental models for contamination of titanium surfaces and disinfection protocols. *Clinical Oral Implants Research*. 2016;27:1233–1242.
- 23.Daubert DM, Weinstein BF. Biofilm as a risk factor in implant treatment. *Periodontology* 2000. 2019;81(1):29–40.
- 24.Weller J, Vasudevan P, Kreikemeyer B, et al. The role of bacterial corrosion on recolonization of titanium implant surfaces: an in vitro study. *Clinical Implant Dentistry and Related Research*. 2022;24(5):664–675.
- 25.Figuero E, Graziani F, Sanz I, Herrera D, Sanz M. Management of peri-implant mucositis and peri-implantitis. *Periodontology* 2000. 2014;66(1):255–273.
- 26.Pereira R, Sabri H, Nava P, Alrmali A, Wang HL. Treatment strategies for peri-implant mucositis: the final stop for preventing peri-implantitis. *International Journal of Dentistry*. 2025;2025:6901156 (9 p.).
- 27.Mombelli A, Décaillot F. The characteristics of biofilms in peri-implant disease. *Journal of Clinical Periodontology*. 2011;38(Suppl 11):203–213. doi:10.1111/j.1600-051X.2010.01666.x
- 28.Coli P, Christiaens V, Sennerby L, De Bruyn H. Reliability of periodontal diagnostic tools for monitoring peri-implant health and disease. *Periodontology* 2000. 2017;73(1):203–217. doi:10.1111/prd.12162
- 29.Albrektsson T, Chrcanovic B, Mólne J, Wennerberg A. Foreign body reactions, marginal bone loss and allergies in relation to titanium implants. *European Journal of Oral Implantology*. 2018;11(Suppl 1):S37–S46.
- 30.Ivanovski S, Bartold PM, Huang YS. The role of foreign body response in peri-implantitis: what is the evidence? *Periodontology* 2000. 2022;90(1):176–185. doi:10.1111/prd.12456
- 31.Lawlor DA, Tilling K, Davey Smith G. Triangulation in aetiological epidemiology. *International Journal of Epidemiology*. 2016;45(6):1866–1886. doi:10.1093/ije/dyw314
- 32.Koldslund OC, Scheie AA, Aass AM. The association between selected risk indicators and severity of peri-implantitis using mixed model analyses. *Journal of Clinical Periodontology*. 2011;38(3):285–292.
- 33.Wang HL, Avila-Ortiz G, Monje A, et al. AO/AAP consensus on prevention and management of peri-implant diseases and conditions: summary report. *Journal of Periodontology*. 2025;96(6):519–541. doi:10.1002/JPER.25-0270
- 34.Plemmenos G, Piperi C. Pathogenic molecular mechanisms in periodontitis and peri-implantitis: role of advanced glycation end products. *Journal of Oral Biology and Dentistry*. 2022;12(4):122–135.
- 35.Ng E, Tay JRH, Mattheos N, et al. A mapping review of the pathogenesis of peri-implantitis: the Biofilm-Mediated Inflammation and Bone Dysregulation (BIND) hypothesis. *Cells*. 2024;13(4):315.
- 36.Darby I. Risk factors for periodontitis and peri-implantitis. *Periodontology* 2000. 2022;90(1):9–12. doi:10.1111/prd.12447
- 37.Karoussis IK, Salvi GE, Heitz-Mayfield LJ, et al. Long-term implant prognosis in patients with and without a history of chronic periodontitis: a 10-year prospective cohort study. *Clinical Oral Implants Research*. 2003;14(3):329–339. doi:10.1034/j.1600-0501.2000.00934.x
- 38.Roccuzzo M, De Angelis N, Bonino L, Aglietta M. Ten-year results of a three-arm prospective cohort study on implants in periodontally compromised patients. *Clinical Oral Implants Research*. 2010;21(5):490–496. doi:10.1111/j.1600-0501.2009.01886.x
- 39.Kordbacheh Changi K, Finkelstein J, Papapanou PN. Peri-implantitis prevalence, incidence rate, and risk factors: a study of electronic health records at a U.S. dental school. *Clinical Oral Implants Research*. 2019;30(4):306–314. doi:10.1111/clr.13416
- 40.Galarraga-Vinueza ME, Pagni S, Finkelman M, et al. Prevalence, incidence, systemic, behavioral, and patient-related risk factors for peri-implant diseases: an AO/AAP systematic review and

- meta-analysis. *Journal of Periodontology*. 2025;96(7):587–633.
41. Cui Z, Wang P, Gao W. Microbial dysbiosis in periodontitis and peri-implantitis: pathogenesis, immune responses, and therapeutic insights. *Frontiers in Cellular and Infection Microbiology*. 2025;15:1517154. doi:10.3389/fcimb.2025.1517154
  42. Van Winkelhoff AJ, Goené RJ, Benschop C, Folmer T. Early colonization of dental implants by putative periodontal pathogens in partially edentulous patients. *Clinical Oral Implants Research*. 2000;11(6):511–520. doi:10.1034/j.1600-0501.2000.011006511.x
  43. Bhuyan R, Das S, et al. Periodontitis and its inflammatory changes linked to systemic diseases: a review. *Biomedicine*. 2022;10(10):2659.
  44. Zheng D, Liwinski T, Elinav E. Interaction between microbiota and immunity in health and disease. *Cell Research*. 2020;30(6):492–506. doi:10.1038/s41422-020-0332-7
  45. Loos BG, Van Dyke TE. The role of inflammation and genetics in periodontal disease. *Periodontology* 2000. 2020;83(1):26–39.
  46. Clementini M, Rossetti PHO, Penarrocha D, et al. Systemic risk factors for peri-implant bone loss: a systematic review and meta-analysis. *International Journal of Oral and Maxillofacial Surgery*. 2014;43(3):323–334.
  47. Heitz-Mayfield LJA, Lang NP. Comparative biology of chronic and aggressive periodontitis vs peri-implantitis. *Periodontology* 2000. 2010;53(1):167–181.
  48. Daubert DM, Weinstein BF, Bordin S, et al. Predictive factors for peri-implant disease and failure: a cross-sectional analysis. *Journal of Periodontology*. 2015;86(3):337–347. doi:10.1902/jop.2014.140438
  49. Heitz-Mayfield LJA, Heitz F, Lang NP. Implant Disease Risk Assessment (IDRA) – a tool for preventing peri-implant disease. *Clinical Oral Implants Research*. 2020;31(4):397–403. doi:10.1111/cr.13585
  50. Stiesch M, Grischke J, Schaefer P, Heitz-Mayfield LJA. Supportive care for the prevention of disease recurrence following peri-implantitis treatment: a systematic review. *Journal of Clinical Periodontology*. 2023;50(S26):113–134.
  51. Ruiz-Romero V, Figueiredo R, Toledano-Serrabona J, et al. Peri-implantitis in patients without regular supportive therapy: prevalence and risk indicators. *Clinical Oral Investigations*. 2024;28:278.
  52. Fardal Ø, Grytten J. A comparison of teeth and implants during maintenance therapy in terms of the number of disease-free years and costs. *Journal of Clinical Periodontology*. 2013;40(6):645–651.
  53. Carra MC, Blanc-Sylvestre N, Courtet A, Bouchard P. Primordial and primary prevention of peri-implant diseases: a systematic review and meta-analysis. *Journal of Clinical Periodontology*. 2023;50(Suppl 26):77–112. doi:10.1111/jcpe.13790
  54. Monje A, Barootchi S, Rosen PS, Wang HL. Surgical- and implant-related factors and onset/progression of peri-implant diseases: an AO/AAP systematic review. *Journal of Periodontology*. 2025;96(6):542–561.
  55. Caton JG, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions. *Journal of Periodontology*. 2018;89(Suppl 1):S1–S8.
  56. Stacchi C, et al. Risk factors for peri-implantitis: effect of history of periodontal disease and smoking habits. *Journal of Oral & Maxillofacial Research*. 2016;7(3):e3.
  57. Dreyer H, et al. Epidemiology and risk factors of peri-implantitis: a systematic review and meta-analysis. *Journal of Clinical Periodontology*. 2018;45(S20):S278–S294.
  58. Sørensen LT. Wound healing and infection in surgery: pathophysiological impact of smoking and smoking cessation. *JAMA Surgery*. 2012;147(4):373–383.
  59. Raulin LA, McPherson JC, McQuade MJ, Hanson BS. The effect of nicotine on attachment of human fibroblasts. *Journal of Periodontology*. 1988;59(5):318–325.
  60. Saoud F, et al. Cigarette smoke modulates inflammation and immunity via DAMP receptors and ROS. *Antioxidants & Redox Signaling*. 2023;38(10–12):781–803.
  61. Qiu F, et al. Impacts of cigarette smoking on immune responsiveness. *Journal of Immunotoxicology*

- logy. 2017;14(1):1–16.
62. Caliri AW, et al. Relationships among smoking, oxidative stress and inflammation. *Carcinogenesis*. 2021;42(5):607–617.
63. Apatzidou DA. The role of cigarette smoking in periodontal disease and implant therapy outcomes. *Periodontology 2000*. 2022;90(1):157–213.
64. Chih SM, et al. Impact of smoking on peri-implant microbiota: a systematic review. *Clinical Oral Implants Research*. 2023;34(6):642–658.
65. Martínez-Amargant J, de Tapia B, Pascual A, et al. Association between smoking and peri-implant diseases: a retrospective study. *Clinical Oral Implants Research*. 2023;34(10):1127–1140. doi:10.1111/clr.14147.
66. Fathi A, Salehi S, Sadeghi S, Atash R, Monirifard R, Farahmand S. Electronic Cigarettes and Peri-Implantitis: An Umbrella Review. *J Oral Implantol*. 2024 Dec 1;50(6):653–658. doi:10.1563/aaid-joi-D-24-00157. PMID: 39390705.
67. Chrcanovic B, Albrektsson T, Wennerberg A. Diabetes and oral implant failure: meta-analysis. *J Dent Res*. 2014;93(9):859–867.
68. Monje A, Catena A, Borgnakke WS. Diabetes ve peri-implantitis üzerine S3-tipi derleme. *Periodontol 2000*. 2017;73(1):20–38.
69. Graziani F, et al. Periodontitis and diabetes: a systematic review and meta-analysis. *J Clin Periodontol*. 2018;45(2):167–187.
70. American Diabetes Association. Standards of Medical Care in Diabetes—2018. *Diabetes Care*. 2018;41(Suppl 1):S1–S159.
71. ElSayed A, et al. Pathophysiology of type 1 and type 2 diabetes. 2025.
72. Johns EC, et al. Gestational diabetes mellitus. *Obstet Gynecol Clin North Am*. 2018;45(2):241–254.
73. Petrie JR, et al. Diabetes, hyperglycaemia and vascular disease. *Heart*. 2018;104(14):1132–1139.
74. Daubert DM, et al. Predictive factors for peri-implant disease and failure. *J Periodontol*. 2015;86(3):337–347.
75. Zhang Z, et al. Diabetes and the peri-implant soft tissue seal. *Front Med/Endocrinol*. 2023.
76. Singh B, et al. Host extracellular matrix proteins in bacterial adhesion/invasion. *FEMS Microbiol Rev*. 2012;36(6):1122–1180.
77. Polak D, Shapira L. Host modulation therapy update. *J Clin Periodontol*. 2017;44(Suppl 15):S118–S129.
78. Venza M, et al. Chemokine receptor expression in oral inflammation. 2010.
79. Bastos MF, et al. RANKL/OPG imbalance in diabetic periodontitis. 2012.
80. Udagawa N. Mechanisms of osteoclast differentiation. *J Bone Miner Metab*. 2003;21(6):337–349.
81. Song C, Dong G, Guo L, Graves DT. Dendritic cells in diabetes-associated periodontitis. *J Dent Res*. 2017;96(1):13–20.
82. Fitzgerald JE, et al. Neutrophil dysfunction in diabetes. 2009.
83. Al-Mulla F, et al. Macrophage polarization and impaired wound healing in diabetes. 2011.
84. Cabral-Pacheco GA, et al. Roles of MMP-8/-9 in ECM remodeling. *Cell Signal*. 2020;66:109477.
85. Arakawa H, et al. Laminin degradation by MMP-9 in peri-implant disease. 2012.
86. Guernieri R, et al. Salivary MMP-9 in peri-implant disease. 2024.
87. Onder C, Alpaslan C. PISF MMP-8 levels and disease severity. 2024.
88. Luchian I, et al. MMPs and peri-implantitis severity. 2025.
89. Dionigi C, Larsson L, Carcuac O, Berglundh T. Hyperglycaemia and oxidative stress in peri-implant inflammation. *J Clin Periodontol*. 2020;47(3):372–381.
90. Ren J, et al. Advanced glycation end products and peri-implant bone loss. *J Periodontol*. 2019;90(7):790–798.
91. Gourlay ML, Sutherland JP, Radley DC. HbA1c and peri-implant inflammation risk. *J Diabetes Res*. 2023;2023:1–9.
92. Al-Askar M, Ajlan S, Alomar N, Al-Daghri NM. Association between peri-implant diseases and HbA1c levels. *Clin Oral Implants Res*. 2018;29(5):479–484.

93. Wagner F, Spille J, Wiltfang J, Naujokat H. Influence of diabetes on dental implant survival: a systematic review. *Int J Implant Dent.* 2022;8(1):25.
94. Subramani K, Jung RE, Molenberg A, Hämmerle CHF. Biofilm on dental implants: a review of the literature. *Int J Oral Maxillofac Implants.* 2009;24(4):616–626.
95. Lafaurie GI, Sabogal MA, Castillo DM, Rincón MV, Gómez LA, Lesmes YA, Chambrone L. Microbiome and microbial biofilm dynamics in peri-implant and periodontal diseases. *J Periodontol.* 2017;88(12):1066–1084.
96. Kocar E, Seme K, Hren NI. Biofilm formation on dental implants in partially edentulous patients. *Clin Oral Implants Res.* 2010;21(8):1002–1009.
97. Sahrman P, Gilli F, Wiedemeier DB, Attin T, Schmidlin PR. The microbiome around dental implants and natural teeth in healthy and diseased states: a systematic review. *Clin Oral Implants Res.* 2020;31(9):734–752.
98. Chen H, Wang M, Zhang Y, Chen C, Zheng Y. Titanium corrosion and particle release as a contributing factor in peri-implant bone loss. *Front Bioeng Biotechnol.* 2023; 11:1110847.
99. Salvi GE, Ramseier CA. Efficacy of patient-administered mechanical and chemical plaque control in supporting peri-implant health. *Periodontol 2000.* 2014;66(1):80–97.
100. Berglundh T, Mombelli A, Schwarz F, Derks J, Tomasi C. Peri-implantitis: pathogenesis and clinical management. *J Clin Periodontol.* 2024;51(Suppl 28):1–42.
101. Cortellini S, Favril C, Nutte M, Teughels W, Quirynen M. Impact of personalized oral hygiene instructions on peri-implant health. *Clin Oral Implants Res.* 2019;30(4):356–365.
102. Clark D, Levin L. Maintenance of implant-supported restorations: a systematic review. *Clin Oral Implants Res.* 2016;27(1):55–70.
103. Colombo APV, Tanner ACR. The role of bacterial biofilms in dental implant infections. *Periodontol 2000.* 2019;79(1):150–166.
104. Monje A, Barootchi S, Rosen P, Wang HL. Surgical and implant-related factors influencing peri-implantitis onset and progression: consensus report of the AAP and AO. *J Clin Periodontol.* 2025;52(Suppl 27):45–70.
105. Fu JH, Hsu YT, Wang HL. Effects of implant placement depth on crestal bone loss: a systematic review. *J Periodontol.* 2012;83(10):1093–1101.
106. Monje A, Blasi G, Ravidà A, Wang HL. Influence of implant position and depth on peri-implant bone and mucosal stability. *Clin Oral Implants Res.* 2016;27(9):1093–1100.
107. Chan HL, Pelekos G, Ho D, Cortellini P, Tonetti MS. Effect of implant depth and transmucosal abutment height on peri-implant tissue health: experimental mucositis model. *J Clin Periodontol.* 2019;46(5):580–590.
108. Moreno H, Borges G, Montero J, Leitão J, Pereira J. Influence of prosthetic emergence profile and angle on peri-implant bone loss: a systematic review. *Clin Oral Implants Res.* 2014;25(9):1119–1127.
109. Borges G, Montero J, Leitão J, Pereira J, Moreno H. Transmucosal abutment height and marginal bone stability around implants: a meta-analysis. *Clin Implant Dent Relat Res.* 2020;22(5):543–552.
110. Salama H, Salama M, Garber DA, Adar P. Guidelines for interimplant papilla preservation and optimal spacing. *Pract Periodontics Aesthet Dent.* 1998;10(8):891–900.
111. Vela X, Méndez C, Rodríguez J, Tarnow D, Cho SC, Wallace SS. Vertical and horizontal implant spacing and papilla preservation: a clinical evaluation. *Int J Periodontics Restorative Dent.* 2000;20(3):285–293.
112. Segalá S, Tarnow DP. The influence of implant-to-tooth distance on papilla height and bone crest level. *Clin Oral Implants Res.* 2012;23(1):82–87.
113. Ravidà A, Saleh I, Giacomazzi E, Wang HL, Sanz-Martin I. Implant position and prosthetic design as risk factors for peri-implant diseases. *Clin Oral Investig.* 2022;26(8):5689–5704.
114. Sadowsky SJ, Fitzpatrick B, Nagy WW, Wang C. Prosthetic design and crestal bone preservation around implants. *Clin Oral Implants Res.* 2017;28(3):303–310.
115. Belibasakis GN, Manoil D, Gurkan A, Bostanci N. Bacterial colonization and crestal bone chan-

- ges at implant margins. *J Periodontol.* 2024;95(2):177–189.
116. Pedrinaci I, Hamilton A, Lanis A, Sanz M, Gallucci G. Prosthetically driven implant positioning and emergence profile in peri-implant health: a consensus review. *Clin Oral Implants Res.* 2024;35(Suppl 29):160–175.
117. Linkevicius T, Vindasiute E, Puisys A, Linkeviciene L, Maslova N, Puriene A. The influence of submucosal margin location on the amount of undetected cement: a prospective clinical study. *Clin Oral Implants Res.* 2011;22(12):1379–1384.
118. Linkevicius T, Vindasiute E, Puisys A, Linkeviciene L. The depth of the implant–restoration margin affects the amount of undetected cement: an in vitro study. *Clin Oral Implants Res.* 2012;23(11):1349–1354.
119. Ivanovski S, Lee R. The peri-implant interface: stability of soft tissues and bone. *Periodontol* 2000. 2017;73(1):188–201.
120. Monje A, Kan JYK, Borgnakke WS. Proximity of prosthetic margin–crestal bone distance as a risk indicator for peri-implantitis: a 9-year cohort study. *J Periodontol.* 2022;93(10):1401–1414.
121. Lang NP, Tonetti MS. Periodontal risk assessment (PRA) and peri-implant disease prevention. *J Clin Periodontol.* 2003;30(Suppl 5):590–595.
122. Annunziata M, Guida L, Blasi G, Ravidà A, Wang HL. Supportive peri-implant maintenance intervals and risk-based protocols. *Clin Oral Implants Res.* 2024;35(Suppl 29):210–225.
123. Ravidà A, Barootchi S, Saleh I, Wang HL, Sanz-Martin I. Soft-tissue dimensions and peri-implant health: a systematic review. *J Periodontol.* 2022;93(8):1135–1152.
124. Mahardawi B, Alqutub MN, Alresayes S, et al. Effect of keratinized mucosa width on peri-implant diseases: a systematic review and meta-analysis. *J Clin Periodontol.* 2023;50(4):520–534.
125. Ramanauskaitė A, Schwarz F, Sader R. The influence of keratinized mucosa width on peri-implant health: a critical review. *Clin Oral Implants Res.* 2022;33(9):923–936.
126. Gobbato L, Avila-Ortiz G, Sohrabi K, Chin-Wei J, Karimbux N. The effect of keratinized mucosa width on peri-implant health: a systematic review. *Int J Oral Maxillofac Implants.* 2013;28(6):1536–1545.
127. Zhang Y, Zhang Z, Wang L, Zeng Q. Soft tissue thickness and peri-implant bone stability: a systematic review. *Clin Oral Investig.* 2025;29(2):311–324.
128. Eroglu S, Sen Y, Oncu E. Association between peri-implant mucosal thickness and marginal bone loss: a cross-sectional study. *Clin Oral Implants Res.* 2024;35(1):85–93.
129. Stefanini M, Rasperini G, Zucchelli G, et al. Influence of soft-tissue phenotype on peri-implant health: a systematic review. *J Periodontol.* 2023;94(Suppl 1):S20–S38.
130. Tavelli L, Barootchi S. The role of keratinized mucosa and soft-tissue augmentation around implants. *Periodontol* 2000. 2025;88(1):145–163.
131. Wu Y, Li J, Zhang Q, et al. Regulatory non-coding RNAs in peri-implant bone stability and inflammation. *Front Cell Dev Biol.* 2019;7:206.
132. Rocuzzo M, Grasso G, Dalmasso P. Keratinized tissue augmentation around dental implants: long-term outcomes of free gingival grafts. *Clin Oral Implants Res.* 2016;27(9):1106–1114.
133. Vinuela RL, Pagni G, Finkelman M, Schoenbaum TR, Chambrone L. Alcohol consumption as a risk indicator for peri-implant diseases: a systematic review. *J Clin Periodontol.* 2025;52(Suppl 27):140–159.
134. Moreno H, Rocha G, Montalvo R, Sanz M. Alcohol intake and peri-implant bone loss: a clinical study. *Clin Oral Implants Res.* 2005;16(5):571–579.
135. Costa FO, Lages EJP, Retamal-Valdes B, et al. Alcohol consumption and peri-implantitis prevalence: a cross-sectional analysis. *J Periodontol.* 2022;93(8):1165–1173.
136. Siles M, Cámara M, Sánchez D, Ferrandis F, Alonso R. Impact of alcohol use on peri-implantitis: a 10-year retrospective study. *Clin Oral Investig.* 2015;19(8):1851–1859.
137. Costa FO, Retamal-Valdes B, Feres M. Liver cirrhosis and peri-implant inflammation: a case-control study. *J Clin Periodontol.* 2021;48(7):957–965.
138. Strooker TR, de Waal YCM, van der Bildt MM. Depression and peri-implantitis: a cross-sectional study. *Clin Oral Implants Res.* 2022;33(7):712–720.

139. Ball S, Darby I. Psychological stress, periodontitis, and peri-implantitis: an overview. *Periodontol* 2000. 2022;89(1):160–178.
140. Schimmel M, Srinivasan M, McKenna G, Müller F. The effect of antidepressant drugs on dental implant failure: a systematic review. *J Dent*. 2018;79:30–37.
141. Silva LF, Santos MBF, Monteiro DR, Carneiro E, Vasconcelos BC. Association between antidepressant use and implant failure: a systematic review and meta-analysis. *Clin Implant Dent Relat Res*. 2021;23(5):673–682.
142. D'Ambrosio F, Papi P, Giannoni M, Di Carlo S, Pompa G. Psychological disorders, medication, and peri-implantitis: a narrative review. *J Oral Rehabil*. 2022;49(10):1069–1082.
143. Lee SY, Kim YT, Kwon TG, et al. Bruxism and dental implant complications: a systematic review. *J Oral Implantol*. 2022;48(4):303–311.
144. Ambrosi A, Frühbeck G. Obesity and its impact on periodontal and peri-implant health. *J Clin Periodontol*. 2025;52(Suppl 27):180–196.
145. Freitas FF, Raitz R, Lemos CAA, de Souza Batista VE. Obesity and peri-implant inflammation: a systematic review and meta-analysis. *Clin Oral Implants Res*. 2018;29(9):1029–1037.
146. Monteiro JL, Lima C, Correia A, Araújo R. Influence of obesity on peri-implant marginal bone loss: a clinical study. *Clin Oral Investig*. 2019;23(12):4243–4252.
147. Muscogiuri G, et al. Obesity and inflammation: molecular mechanisms and clinical implications. *Int J Obes (Lond)*. 2021;45(9):1863–1875.
148. Elangovan S, et al. Peri-implant sulcular fluid biomarkers and obesity: a cross-sectional study. *J Periodontol*. 2014;85(5):683–691.
149. Kim JH, et al. Overweight and obesity as risk indicators for dental implant failure and peri-implantitis: a meta-analysis. *J Periodontol*. 2017;88(9):1075–1083.
150. Vohra F, Al-Kheraif AA, Qadri T, et al. Relationship between obesity and peri-implant inflammatory response: a clinical study. *Clin Implant Dent Relat Res*. 2017;19(3):458–464.
151. Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. *Lancet*. 2005;365(9468):1415–1428.
152. Oliveira LP, et al. Metabolic syndrome and peri-implantitis: clinical and molecular correlations. *J Periodontol*. 2020;91(10):1284–1293.
153. Guo X, Wang C, Liu D, et al. Mechanisms linking metabolic dysfunction and peri-implant bone loss: a review. *Front Endocrinol*. 2024;15:1367114.
154. Tonetti MS, Van Dyke TE. Periodontitis and atherosclerotic cardiovascular disease: consensus report of the Joint EFP/AAP Workshop. *J Clin Periodontol*. 2013;40(Suppl 14):S24–S29.
155. Mombelli A. Microbiology and antimicrobial therapy of peri-implantitis. *Periodontol* 2000. 2002;28:177–189.
156. Koyanagi T, Sakamoto M, Takeuchi Y, Ohkuma M, Izumi Y. Comprehensive microbiological findings in peri-implantitis and periodontitis. *J Clin Periodontol*. 2012;39(6):525–533.
157. Ching HS, Lee YL, Wang CY, Chen YT, Tsai CC. Relationship between peri-implant pathogens and cardiovascular disease: a cross-sectional study. *J Periodontol*. 2020;91(8):1034–1043.
158. Faot F, Costa FO, Lages EJP, Retamal-Valdes B, Feres M. Local and systemic inflammatory markers in peri-implantitis and cardiovascular disease. *Clin Oral Investig*. 2015;19(8):1867–1876.
159. Salvi GE, Aglietta M, Eick S, Sculean A, Lang NP, Ramseier CA. Systemic inflammatory response in peri-implantitis: CRP and cytokine profile. *J Clin Periodontol*. 2023;50(Suppl 27):115–133.
160. Yan Z, Huang X, Zhang Z, et al. Circulating biomarkers linking peri-implantitis and cardiovascular disorders. *Front Immunol*. 2023;14:1186572.
161. Renvert S, Aghazadeh A, Hallström H, Persson GR. Factors related to peri-implantitis and implant loss: a long-term follow-up study. *Clin Oral Implants Res*. 2013;24(8):1098–1104.
162. Froum SJ, Rosen PS, Yu P, Khoully I. Peri-implantitis and systemic disease connections: a literature review. *Int J Periodontics Restorative Dent*. 2020;40(3):e151–e160.
163. Thomas GW. Cement-retained implant restorations: clinical considerations and maintenance. *J Prosthodont*. 2009;18(1):77–84.
164. Vigolo P, Mutinelli S, Zaccaria M, Stellini E. Cemented versus screw-retained implant-suppor-

- ted single-tooth crowns: 10-year results of a randomized controlled trial. *Int J Oral Maxillofac Implants*. 2015;30(5):1106–1112.
165. Lin GH, Chan HL, Wang HL. The effect of restorative design on implant complications: a systematic review. *J Prosthet Dent*. 2025;133(2):223–238.
166. Korsch M, Walther W. The influence of cements on peri-implant health: a retrospective clinical study. *Clin Implant Dent Relat Res*. 2014;16(3):366–373.
167. Pesce P, Canullo L, Grusovin MG, de Bruyn H, Cosgarea R. Systematic review of the effect of screw- vs cement-retained prostheses on peri-implant tissues. *Clin Oral Investig*. 2015;19(8):1801–1817.
168. Kotsakis GA, Zhang L, Gaillard P, Raedel M, Walter MH, Konstantinidis I. Cement and peri-implant disease: systematic review and meta-analysis. *Clin Oral Implants Res*. 2016;27(11):1652–1664.
169. Yi Y, Koo KT, Schwarz F, Ben Amara H, Heo SJ. Mechanical and biological complications of splinted versus non-splinted implants: a systematic review and meta-analysis. *J Periodontol*. 2023;94(5):634–648.
170. Monje A, Pommer B. The concept of platform switching and marginal bone preservation: a systematic review. *Clin Oral Implants Res*. 2015;26(9):1137–1149.
171. Dixon DR, London RM. Platform switching in dental implants: evidence-based review. *Compend Contin Educ Dent*. 2019;40(1):e1–e6.
172. Garzón I, et al. Internal vs external connection implants and marginal bone loss: a randomized clinical trial. *Clin Oral Investig*. 2018;22(3):1385–1393.
173. Galindo-Moreno P, et al. Influence of abutment height on marginal bone loss around dental implants: a randomized clinical trial. *Clin Oral Implants Res*. 2014;25(10):1122–1128.
174. Saleh M, Montero J, Lund B, et al. Transmucosal abutment height and peri-implant bone stability: a systematic review. *Clin Oral Investig*. 2022;26(4):3567–3580.
175. Laleman I, Lambert F. Soft tissue seal and abutment height: clinical considerations. *J Clin Periodontol*. 2023;50(Suppl 27):260–270.
176. Canullo L, Bignozzi I, Cocchetto R, Cristalli MP, Iannello G. Immediate placement and one abutment-one time technique: a clinical and histologic evaluation. *Int J Periodontics Restorative Dent*. 2010;30(6):639–647.
177. Toia M, Stacchi C, Pranno N, et al. One abutment–one time concept on marginal bone stability: a 5-year randomized controlled trial. *J Prosthodont Res*. 2021;65(2):193–201.
178. Su H, Martin WC, Weisgold A, Lee A. Influence of implant emergence profile on peri-implant tissue health. *Clin Oral Implants Res*. 2010;21(3):317–321.
179. Katakuchi M, Weinstein BF, Leroux BG, Chen YW, Daubert DM. Risk factors for peri-implant bone loss: implant prosthesis design and emergence angle. *Clin Oral Implants Res*. 2017;28(5):612–617.
180. Saleh M, Montero J, Lund B, et al. Effect of occlusal load on peri-implantitis progression: a systematic review. *Clin Oral Investig*. 2022;26(12):7411–7423.
181. Carcuac O, et al. Genetic and molecular aspects of peri-implantitis. *J Dent Res*. 2012;91(9):884–890.
182. Larsson L, Decker AM, Nibali L, Pilipchuk SP, Berglundh T, Giannobile WV. Regenerative medicine for periodontal and peri-implant diseases. *J Dent Res*. 2022;101(3):257–266.
183. Gurlek A, Gumus P, Nile C, Lappin DF, Buduneli N. Cytokine profiles in peri-implant and periodontal tissues. *J Periodontol*. 2017;88(7):753–761.
184. Larsson L, et al. Epigenetic regulation of inflammation in peri-implant disease. *Clin Epigenetics*. 2022;14(1):89.
185. Asa'ad F, Monje A, Larsson L. Influence of titanium particles on peri-implant inflammation: an epigenetic perspective. *Clin Oral Investig*. 2019;23(9):3541–3550.
186. Asa'ad F, Larsson L, Thomsen P, Monje A. Epigenetic therapeutics in peri-implantitis: future directions. *Periodontol 2000*. 2020;84(1):160–177.
187. Daubert DM, Weinstein BF, Bordin S, Leroux BG, Flemmig TF. Titanium exposure and inflam-

- matory gene expression in peri-implant tissues. *Clin Oral Implants Res.* 2019;30(2):151–159.
- 188.Larsson L, et al. Epigenetic control of bone regeneration and inflammation: implications for peri-implantitis. *J Clin Periodontol.* 2022;49(Suppl 27):S312–S322.
- 189.Laine ML, Leonhardt A, Roos-Jansåker AM, Dahlen G, Berglundh T. IL-1 genotype and peri-implantitis susceptibility. *J Clin Periodontol.* 2006;33(12):944–950.
- 190.Cardoso EM, et al. Interleukin-1 polymorphisms and peri-implant bone loss: systematic review and meta-analysis. *J Periodontol.* 2022;93(4):576–590.
- 191.Delaney C, et al. Association between IL-1 polymorphisms and peri-implantitis risk: a meta-analysis. *Clin Oral Investig.* 2015;19(6):1101–1111.
- 192.Chen X, Zhaso T. Gene variants in IL-6, TNF- $\alpha$ , and MMPs associated with peri-implant tissue destruction. *J Periodontal Res.* 2019;54(3):233–242.