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BÖLÜM 1

ORTODONTİK TEDAVİLERDE ÜÇ BOYUTLU (3D) APAREY TASARIMI VE ÜRETİMİ

Serra ERTEMEL ARIK[1]
Esra GENÇ[2]

GİRİŞ

Eklemeli imalat olarak da adlandırılan üç boyutlu (3D) baskı, dijital modellerden katı nesneler üretmek için malzemeleri katman katman biriktiren bir süreçtir (1). Ekleme yöntemi 1980'lerde prototip, model ve döküm örneklerinin üretiminde kullanılmaya başlanmıştır. Bu nedenle tabaka ekleme üretimi kullanılarak modellerin hızlı üretimine "hızlı prototipleme (rapid prototyping)" adı verilmiştir. Günümüzde ekleme yöntemi; ön üretimden tam sistem üretimine, hatta şekillendirme ve üretim sonrası düzenlemeye kadar ürün döngüsünün her alanında kullanılabilen teknolojileri tanımlar (2). Charles Hull tarafından icat edilen ilk 3D yazıcının 1980'lerin ortalarında Amerika Birleşik Devletleri'nde piyasaya sürülmesinden bu yana, çeşitli 3D baskı süreçleri ve malzemeleri geliştirilmiştir (3). 3D baskının değere sahip olması için yazdırılacak nesnelerin oluşturulması gerekmektedir; bu sebeple bilgisayar destekli yazılım programı denilen CAD yazılımı, sıfırdan nesneler oluşturulmasını sağlar (4). CAD yazılımı, 3D görüntüleri oluşturur, değiştirir, analiz eder, işler ve yalnızca diş hekimliğinde değil, aynı zamanda mühendislik, havacılık ve mimaride de yaygın olarak kullanılır (5). Diş hekimliğinde, daha çok "frezeleme" olarak tanımlanan eksiltici imalat ile de üç boyutlu nesneler üretilmektedir. Eksiltici imalat, bir nesne oluşturmak için blok halindeki malzemenin yontulmasıdır (6). Diş hekimliğinde 3 boyutlu materyallerin üretimi için doğruluk açısından, birçok çalışma, freze sistemini yeterli performansa sahip olduğunu bildirmiştir (7).

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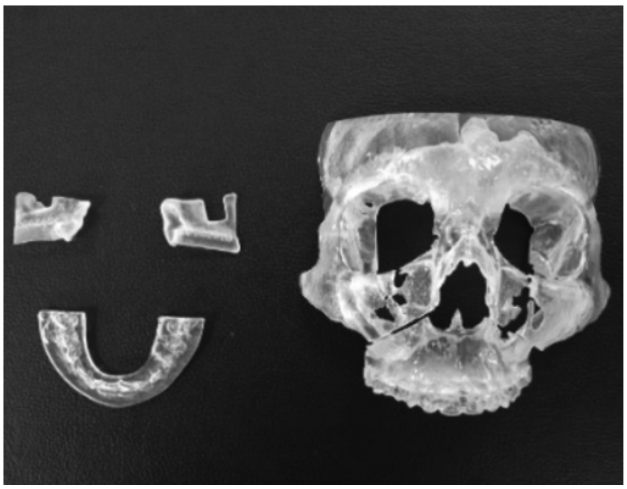

Şekil 15: Ortognatik cerrahi planlanan hastanın 3D baskı modeli. Lefort I osteotomi klavuzu ve okluzal splinti (97)

SONUÇ

Klinik diş hekimliğinde ve özellikle de ortodontide 3D baskı uygulamaları için açıkça büyük bir potansiyel vardır. Bu durum, özellikle yazılım ve farklı fiziksel süreçlerde uzmanlaşma konusunda geleneksel yöntemlerden tamamen dijital bir iş akışına geçişi içeriyor olsa da, teknolojik gelişimlerle birlikte ortodontik kullanımlar için daha da yaygınlaşacağı şüphe götürmeyen bir gerçektir.

KAYNAKÇA

1. Dawood A, Marti Marti B, Sauret-Jackson V, Darwood A. 3D printing in dentistry [published correction appears in Br Dent J. 2016 Jan 22;220(2):86]. *Br Dent J*. 2015;219(11):521-529.
2. van Noort R. The future of dental devices is digital. *Dent Mater*. 2012;28(1):3-12.
3. Vehse M, Seitz H. A new micro-stereolithography-system based on diode laser curing (DLC). *International journal of precision engineering and manufacturing*, 2014;15:2161-2166.
4. Tian Y, Chen C, Xu X, et al. A Review of 3D Printing in Dentistry: Technologies, Affecting Factors, and Applications. *Scanning*. 2021;2021:9950131. Published 2021 Jul 17.
5. Panayi NC. DIY orthodontics: design it yourself. Chicago: Quintessence Publishing; 2021.
6. Azari A, Nikzad S. The evolution of rapid prototyping in dentistry: a review. *Rapid Prototyping Journal*, 2009;15(3), 216-225.

7. Hüttig F, Keitel JP, Prutscher A, Spintzyk S, Klink A. Fixed Dental Prostheses and Single-Tooth Crowns Based on Ceria-Stabilized Tetragonal Zirconia/Alumina Nanocomposite Frameworks: Outcome After 2 Years in a Clinical Trial. *Int J Prosthodont*. 2017;30(5):461–464.
8. Kihara H, Sugawara S, Yokota J, et al. Applications of three-dimensional printers in prosthetic dentistry. *J Oral Sci*. 2021;63(3):212-216. doi:10.2334/josnusd.21-0072
9. Davidowitz G, Kotick PG. The use of CAD/CAM in dentistry. *Dent Clin North Am*. 2011;55(3):559-ix. doi:10.1016/j.cden.2011.02.011
10. Francisco I, Ribeiro MP, Marques F, et al. Application of Three-Dimensional Digital Technology in Orthodontics: The State of the Art. *Biomimetics (Basel)*. 2022;7(1):23. Published 2022 Feb 2.
11. Karatas OH, Toy E. Three-dimensional imaging techniques: A literature review. *Eur J Dent*. 2014;8(1):132-140. doi:10.4103/1305-7456.126269.
12. De Grauwe A, Ayaz I, Shujaat S, et al. CBCT in orthodontics: a systematic review on justification of CBCT in a paediatric population prior to orthodontic treatment. *Eur J Orthod*. 2019;41(4):381-389. doi:10.1093/ejo/cjy066
13. Cousley RR. Introducing 3D printing in your orthodontic practice. *J Orthod*. 2020;47(3):265-272.
14. Nguyen TT, Jackson TH. 3D technologies for precision in orthodontics. *Seminars in Orthodontics*, 2018;24,386-392.
15. Fan D, Li Y, Wang X, et al. Progressive 3D Printing Technology and Its Application in Medical Materials. *Front Pharmacol*. 2020;11:122. Published 2020 Mar 20. doi:10.3389/fphar.2020.00122
16. Sakly A, Kenzari S, Bonina D, Corbel S, et al. A novel quasicrys- tal-resin composite for stereolithography, Mater. Des. 2014;56,280–285.
17. Jain R, Supriya BS, Gupta K. Recent trends of 3-D printing in dentistry-a review, *Ann Prosthodont Rest Dent*, 2016; 2(1),101-104.
18. Hazeveld A, Huddleston Slater JJ, Ren Y. Accuracy and reproducibility of dental replica models reconstructed by different rapid prototyping techniques. *Am J Orthod Dentofacial Orthop*. 2014;145(1):108-115. doi:10.1016/j.ajodo.2013.05.011
19. Aly P, Mohsen C. Comparison of the Accuracy of Three-Dimensional Printed Casts, Digital, and Conventional Casts: An In Vitro Study. *Eur J Dent*. 2020;14(2):189-193. doi:10.1055/s-0040-1705243
20. Sakly A, Kenzari S, Bonina D, Corbel S, Fournée V. A novel quasicrystal-resin composite for stereolithography. *Materials & Design (1980-2015)*, 2014; 56, 280-285.
21. Bustillos J, Montero-Zambrano D, Loganathan A, Boesl B, Agarwal A. Stereolithography-based 3D printed photosensitive polymer/boron nitride nanoplatelets composites, Polym. Compos. 2019; *40*(1), 379-388.
22. França R, Winkler J, Hsu HH, Rahimnejad M, Abdali Z. 3D printing—Additive manufacturing of dental biomaterials. In *Dental Biomaterials* 2019; 421-462.
23. Sun C, Fang N, Wu DM, Zhang X. Projection micro-stereolithography us- ing digital micro-mirror dynamic mask, Sensors Actuators A Phys. 2005;121,113–120.
24. Lu Y, Mapili G, Suhali G, Chen S, Roy K. A digital micro-mirror device-based system for the microfabrication of complex, spatially patterned tissue engineering scaffolds. *J Biomed Mater Res A*. 2006;77(2):396-405. doi:10.1002/jbm.a.30601

25. He Y, Wu Y, Fu JZ, Gao Q, Qiu JJ. Developments of 3D Printing Microfluidics and Applications in Chemistry and Biology: a Review, Electroanalysis 2016;28(8), 1658-1678.
26. Jain P, Kuthe AM. Feasibility study of manufacturing using rapid prototyping: FDM approach, Procedia Eng. 2013; 63, 4–11.
27. Soriano Heras E, Blaya Haro F, de Agustin del Burgo JM, Islán Marcos ME. Plate auto-level system for fused deposition modelling (FDM) 3D printers, *Rapid Prototyping Journal*, 2017;*23*(2), 401-413.
28. Kessler A, Hickel R, Reymus M. 3D Printing in Dentistry-State of the Art. *Oper Dent*. 2020;45(1):30-40. doi:10.2341/18-229-L
29. Cuan-Urquizo E, Barocio E, Tejada-Ortigoza V, Pipes RB, Rodriguez CA, Roman-Flores A. Characterization of the Mechanical Properties of FFF Structures and Materials: A Review on the Experimental, Computational and Theoretical Approaches. *Materials (Basel)*. 2019;12(6):895. Published 2019 Mar 18. doi:10.3390/ma12060895.
30. Jain P, Kuthe AM. Feasibility study of manufacturing using rapid prototyping: FDM approach, Procedia Eng. 2013;63, 4–11.
31. Olakanmi EO, Cochrane RF, Dalgarno KW. A review on selective laser sintering/melting (SLS/SLM) of aluminium alloy powders: processing, microstructure, and properties, Prog. Mater. Sci. 74 (2015) 401–477.
32. Tolochko NK, Savich VV, Laoui T, Froyen L, Onofrio G, Signorelli E, Titov VI. Dental root implants produced by the combined selective laser sintering/melting of titanium powders, Proc. Inst. Mech. Eng. Part L J. Mater. Des. Appl. 2002;216 (4) 267–270.
33. Kruth JP, Vandenbroucke B, Van Vaerenbergh J, Naert I. Rapid manufactur ing of dental prostheses by means of selective laser sintering/melting, Proc. AFPR S. 2005;4, 176–186.
34. Alageel O, Abdallah MN, Alsheghri A, Song J, Caron E, Tamimi F. Removable partial denture alloys processed by laser-sintering technique. *J Biomed Mater Res B Appl Biomater*. 2018;106(3):1174-1185. doi:10.1002/jbm.b.33929
35. Lakshminarayan U, Ogrydiziak S, Marcus HL. Selective laser sintering of ceramic materials, 1990 Int. Solid Free. Fabr. Symp, 1990.
36. Wohlert M, Bourell D. Rapid prototyping of Mg/SiC composites by a combined SLS and pressureless infiltration process, 1996 Int. Solid Free. Fabr. Symp., 1996
37. Leong SS, Yee YW, Edith WF, Yen TB, et al. Shoufeng, Direct selective laser sintering and melting of ceramics: a review, Rapid Prototyp. J. Direct selective laser sintering and melting of ceramics: a review. *Rapid Prototyping Journal*, 2017;*23*(3),611-623.
38. Mai HN, Lee KB, Lee DH. Fit of interim crowns fabricated using photopolymer-jetting 3D printing. *J Prosthet Dent*. 2017;118(2):208-215. doi:10.1016/j.prosdent.2016.10.030
39. Hazeveld A, Huddleston Slater JJ, Ren Y. Accuracy and reproducibility of dental replica models reconstructed by different rapid prototyping techniques. *Am J Orthod Dentofacial Orthop*. 2014;145(1):108-115. doi:10.1016/j.ajodo.2013.05.011
40. Mostafaei A, Stevens EL, Ference JJ, Schmidt DE et al. Binder jet printing of partial denture metal, Mater. Sci. Technol. 2017 (2017) 289–291.
41. Stansbury JW, Idacavage MJ. 3D printing with polymers: Challenges among expanding options and opportunities. *Dent Mater*. 2016;32(1):54-64. doi:10.1016/j.dental.2015.09.018

42. Fleming PS, Marinho V, Johal A. Orthodontic measurements on digital study models compared with plaster models: a systematic review. *Orthod Craniofac Res*. 2011;14(1):1-16.
43. Jang Y, Sim JY, Park JK, Kim WC, Kim HY, Kim JH. Accuracy of 3-unit fixed dental prostheses fabricated on 3D-printed casts. *J Prosthet Dent*. 2020;123(1):135-142.
44. Kasparova M, Grafova L, Dvorak P, et al. Possibility of reconstruction of dental plaster cast from 3D digital study models. *Biomed Eng Online*. 2013;12:49. Published 2013 May 31.
45. Jeong YG, Lee WS, Lee KB. Accuracy evaluation of dental models manufactured by CAD/CAM milling method and 3D printing method. *J Adv Prosthodont*. 2018;10(3):245-251.
46. Hazeveld A, Huddleston Slater JJ, Ren Y. Accuracy and reproducibility of dental replica models reconstructed by different rapid prototyping techniques. *Am J Orthod Dentofacial Orthop*. 2014;145(1):108-115. doi:10.1016/j.ajodo.2013.05.011
47. Waldecker M, Leckel M, Rammelsberg P, Bömicke W. Fully digital fabrication of an occlusal device using an intraoral scanner and 3D printing: A dental technique. *J Prosthet Dent*. 2019;121(4):576-580. doi:10.1016/j.prosdent.2018.09.021
48. Bauermeister AJ, Zuriarrain A, Newman MI. Three-Dimensional Printing in Plastic and Reconstructive Surgery: A Systematic Review. *Ann Plast Surg*. 2016;77(5):569-576.
49. Azuma M, Yanagawa T, Ishibashi-Kanno N, et al. Mandibular reconstruction using plates prebent to fit rapid prototyping 3-dimensional printing models ameliorates contour deformity. *Head Face Med*. 2014;10:45. Published 2014 Oct 23. doi:10.1186/1746-160X-10-45
50. Hsieh TY, Dedhia R, Cervenka B, Tollefson TT. 3D Printing: current use in facial plastic and reconstructive surgery. *Curr Opin Otolaryngol Head Neck Surg*. 2017;25(4):291-299.
51. Cai H, Zhao BC, Tian Y, et al. Design of a Single-Tooth Model and Its Application in Oral Scan System Assessment. *Scanning*. 2021;2021:8891396. Published 2021 Mar 21.
52. Ré JP, Chossegros C, El Zoghby A, Carlier JF, Orthlieb JD. Gouttières occlusales. Mise au point [Occlusal splint: state of the art]. *Rev Stomatol Chir Maxillofac*. 2009;110(3):145-149.
53. Berli C, Thieringer FM, Sharma N, et al. Comparing the mechanical properties of pressed, milled, and 3D-printed resins for occlusal devices. *J Prosthet Dent*. 2020;124(6):780-786.
54. Salmi M, Paloheimo KS, Tuomi J, Ingman T, Mäkitie A. A digital process for additive manufacturing of occlusal splints: a clinical pilot study. *J R Soc Interface*. 2013;10(84):20130203. Published 2013 Apr 24. doi:10.1098/rsif.2013.0203.
55. Lutz AM, Hampe R, Roos M, Lümkemann N, Eichberger M, Stawarczyk B. Fracture resistance and 2-body wear of 3-dimensional-printed occlusal devices. *J Prosthet Dent*. 2019;121(1):166-172.
56. Makvandi P, Esposito Corcione C, Paladini F, et al. Antimicrobial modified hydroxyapatite composite dental bite by stereolithography, Polym. Adv. Technol. 2018 *29*(1), 364-371.
57. Musich D, Busch MJ. Early orthodontic treatment: current clinical perspectives. *Alpha Omegan*. 2007;100(1):17-24. doi:10.1016/j.aodf.2006.07.003

58. Tsomos G, Ludwig B, Grossen J, Pazera P, Gkantidis N. Objective assessment of patient compliance with removable orthodontic appliances: a cross-sectional cohort study. *Angle Orthod*. 2014;84(1):56-61. doi:10.2319/042313-315.1
59. Proffit WR. Contemporary orthodontics. 5th ed. St Louis: Mosby; 2013
60. Zhang J, Yang Y, Han X, et al. The application of a new clear removable appliance with an occlusal splint in early anterior crossbite. *BMC Oral Health*. 2021;21(1):36. Published 2021 Jan 21.
61. Kalange JT, Thomas RG. Indirect bonding: a comprehensive review of the literature. Semin Orthod. 2007;13(1):3–10.
62. Gange P. The evolution of bonding in orthodontics. Am J Orthod Dentofacial Orthop. 2015;147(4):56–63.
63. Duarte MEA, Gribel BF, Spitz A, Artese F, Miguel JAM. Reproducibility of digital indirect bonding technique using three-dimensional (3D) models and 3D-printed transfer trays. *Angle Orthod*. 2020;90(1):92-99. doi:10.2319/030919-176.1
64. Israel M, Kusnoto B, Evans CA, Begole E. A comparison of traditional and computer-aided bracket placement methods. Angle Orthod. 2011;81(5):828–835.
65. Panayi NC. In-house three-dimensional designing and printing customized brackets. *J World Fed Orthod*. 2022;11(6):190-196.
66. Panayi NC, Tsolakis AI. In-house computer-aided design and 3-dimensional printing of customized orthodontic brackets using hybrid ceramic resin: is it the time for the orthodontist to take over? Am J Orthod Dentofac Orthop 2021;1:187–93.
67. Panayi NC. In-house three-dimensional designing and printing customized brackets. *J World Fed Orthod*. 2022;11(6):190-196
68. Graf S, Tarraf NE, Kravitz ND. Three-dimensional metal printed orthodontic laboratory appliances. Semin Orthod 2021;27:189–93.
69. Teeters CA. Simultaneous Phase I expansion and ectopic molar correction with a hyrax-Halterman appliance. J Clin Orthod 2017;51:295–300.
70. Graf S, Berger M, Rohr N. Influence of printing procedure and printing axis of dental alloys on dimensional accuracy, surface roughness, and porosity. APOS Trends Orthod 2022;12:149–56.
71. Firlej M, Pieniak D, Niewczas AM, et al. Effect of Artificial Aging on Mechanical and Tribological Properties of CAD/CAM Composite Materials Used in Dentistry. *Materials (Basel)*. 2021;14(16):4678. Published 2021 Aug 20. doi:10.3390/ma14164678
72. Klocke A, Kahl-Nieke B, Adam G, Kemper J. Magnetic forces on orthodontic wires in high field magnetic resonance imaging (MRI) at 3 tesla. *J Orofac Orthop*. 2006;67(6):424-429.
73. Strassler HE, Serio CL. Esthetic considerations when splinting with fiber-reinforced composites. *Dent Clin North Am*. 2007;51(2):507-xi. doi:10.1016/j.cden.2006.12.004
74. Barenghi L, Barenghi A, Cadeo C, Di Blasio A. Innovation by Computer-Aided Design/Computer-Aided Manufacturing Technology: A Look at Infection Prevention in Dental Settings. *Biomed Res Int*. 2019;2019:6092018. Published 2019 Aug 6. doi:10.1155/2019/6092018
75. Firlej M, Zaborowicz K, Zaborowicz M, et al. Mechanical Properties of 3D Printed Orthodontic Retainers. *Int J Environ Res Public Health*. 2022;19(9):5775. Published 2022 May 9.

76. Fathian M, Kennedy DB, Nouri RM, Ped D. Laboratory-made space main- tainers: a 7-year retrospective study from private pediatric dental practice. Pediatr Dentistry 29(6):500-506, 2007.
77. Khanna S, Rao D, Panwar S, Pawar BA, Ameen S. 3D Printed Band and Loop Space Maintainer: A Digital Game Changer in Preventive Orthodontics. *J Clin Pediatr Dent*. 2021;45(3):147-151.
78. Yu X, Li G, Zheng Y, et al. 'Invisible' orthodontics by polymeric 'clear' aligners molded on 3D-printed personalized dental models. *Regen Biomater*. 2022;9(1):rbac007. Published 2022 Feb 4.
79. Gerard Bradley T, Teske L, Eliades G, Zinelis S, Eliades T. Do the mechanical and chemical properties of InvisalignTM appliances change after use? A retrieval analysis. *Eur J Orthod*. 2016;38(1):27-31. doi:10.1093/ejo/cjv003
80. Ryu JH, Kwon JS, Jiang HB, Cha JY, Kim KM. Effects of thermoforming on the physical and mechanical properties of thermoplastic materials for transparent orthodontic aligners. *Korean J Orthod*. 2018;48(5):316-325. doi:10.4041/kjod.2018.48.5.316
81. Zinelis S, Panayi N, Polychronis G, Papageorgiou SN, Eliades T. Comparative analysis of mechanical properties of orthodontic aligners produced by different contemporary 3D printers. *Orthod Craniofac Res*. 2022;25(3):336-341. doi:10.1111/ocr.12537
82. Tamburrino F, D'Antò V, Bucci R, Alessandri-Bonetti G, Barone S, Razionale AV. Mechanical Properties of Thermoplastic Polymers for Aligner Manufacturing: In Vitro Study. *Dent J (Basel)*. 2020;8(2):47. Published 2020 May 10. doi:10.3390/dj8020047
83. Jindal P, Juneja M, Siena FL, Bajaj D, Breedon P. Mechanical and geometric properties of thermoformed and 3D printed clear dental aligners. *Am J Orthod Dentofacial Orthop*. 2019;156(5):694-701. doi:10.1016/j.ajodo.2019.05.012
84. Shivapuja P, Shah D, Shah N, Shah S. Direct 3D-Printed Orthodontic Aligners with Torque, Rotation, and Full Control Anchors. U.S. Patent No. 10,179,035, 15 January 2019.
85. Nakano H, Kato R, Kakami C, Okamoto H, Mamada K, Maki K. Development of biocompatible resins for 3D printing of direct aligners. *J Photopolym Sci Tec*. 2019;32(2):209-216
86. Maspero C, Tartaglia GM. 3D printing of clear orthodontic aligners: where we are and where we are going. *Materials*. 2020; 13(22):5204.
87. Tartaglia GM, Mapelli A, Maspero C, et al. Direct 3D Printing of Clear Orthodontic Aligners: Current State and Future Possibilities. *Materials (Basel)*. 2021;14(7):1799. Published 2021 Apr 5.
88. Nanda, R.; Garino, F.; Ojima, K.; Castroflorio, T.; Parrini, S. Chapter 12: The hybrid approach in Class II malocclusions treatment. In *Principles and Biomechanics of Aligner Treatment—E-Book*, 1st ed.; Elsevier Health Sciences: Amsterdam, The Netherlands, 2021; Volume 1, pp. 149–160.
89. Grec RH, Janson G, Branco NC, Moura-Grec PG, Patel MP, Castanha Henriques JF. Intraoral distalizer effects with conventional and skeletal anchorage: a meta-analysis. *Am J Orthod Dentofacial Orthop*. 2013;143(5):602-615. doi:10.1016/j.ajodo.2012.11.024
90. Carrière L. A new Class II distalizer. *J Clin Orthod.* 2004;38:224–231.

91. Thurzo A, Urbanová W, Novák B, Waczulíková I, Varga I. Utilization of a 3D Printed Orthodontic Distalizer for Tooth-Borne Hybrid Treatment in Class II Unilateral Malocclusions. *Materials (Basel)*. 2022;15(5):1740. Published 2022 Feb 25. doi:10.3390/ma15051740
92. Xia J, Ip HH, Samman N, Wang D, Kot CS, Yeung RW, et al. Computerassisted three-dimensional surgical planning and simulation: 3D virtual osteotomy. Int J Oral Maxillofac Surg 2000;29:11
93. Kurenov SN, Ionita C, Sammons D, Demmy TL. Three-dimensional printing to facilitate anatomic study, device development, simulation, and planning in thoracic surgery. *J Thorac Cardiovasc Surg*. 2015;149(4):973-9.e1. doi:10.1016/j.jtcvs.2014.12.059
94. Van Assche N, van Steenberghe D, Guerrero ME, et al. Accuracy of implant placement based on pre-surgical planning of three-dimensional cone-beam images: a pilot study. *J Clin Periodontol*. 2007;34(9):816-821.
95. Lin HH, Lonic D, Lo LJ. 3D printing in orthognathic surgery - A literature review. *J Formos Med Assoc*. 2018;117(7):547-558.
96. Wang H, Guan QL, Yang YH, Wang YZ. Personal Guide Assisted Orthognathic Surgery: Application of a T-shaped Tooth Bone Combined Supporting Osteotomy Guide Plate and Positioning Guide Plate. *J Craniofac Surg*. 2022;33(7):e736-e738.
97. Zinser MJ, Mischkowski RA, Sailer HF, Zöller JE. Computer-assisted orthognathic surgery: feasibility study using multiple CAD/CAM surgical splints. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2012;113(5):673-687.

Bölüm 2

ALT ÇENE GERİLİĞİNDEN KAYNAKLI SINIF II MALOKLUZYONLARIN FONKSİYONEL ORTOPEDİK TEDAVİSİNDE INVISALIGN MA

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GİRİŞ

İskeletsel kökenli Sınıf II malokluzyonlar maksiller protrüzyon, mandibuler retrüzyon veya her ikisinin kombinasyonu neticesinde oluşmaktadır (1–3). Çenelerin sagital yön uyumsuzluğuna sıklıkla transversal ve vertikal yön problemleri de eşlik etmektedir (4). Retrognatik mandibuladan kaynaklı Sınıf II malokluzyonlar, orofasial yapıların estetiğini ve fonksiyonel yapılarını olumsuz yönde etkileyebilen yaygın bir deformitedir (5). Bu deformite aynı zamanda damak boyutu (6), ağız solunumu (7), uyku apnesi (8), atipik yutkunma (9), kötü alışkanlıklar (10) veya TME bozuklukları (11) gibi ortodontistin dikkatini gerektiren çeşitli klinik durumlarla da ilişkili olabilmektedir. Etiyolojisi karmaşık olmakla birlikte genel olarak kalıtım, çevresel faktörler, hastalıklar ve temporomandibuler eklemi (TME) olumsuz etkileyen birçok faktör Sınıf II malokluzyonun oluşumunda rol almaktadır.

Retrognatik mandibuladan kaynaklı Sınıf II malokluzyonun büyüme gelişim dönemindeki tedavisinde, mandibuler büyümeyi indüklemek için yıllar boyunca çok çeşitli hareketli (Twin Blok, Bionator, Frankel ve aktivatörler vs.) ve sabit (Herbst, Powerscope ve MARA vs.) fonksiyonel apareyler tasarlanmış ve uygulanmıştır (2,12,13). Ancak geleneksel fonksiyonel ortopedik apareyler dental arkların düzeltilmesinde konforsuz ve zahmetli olabilmekle beraber tedavi süresi uzayabilmektedir (5). Hareketli apareylerin takıp çıkarılabilir ve temizlenebilir olması, yapımlarının kolay olması, maliyetlerinin düşük olması ve ağız hijyeninin kolay sağlanabilmesi gibi avantajlarının yanı sıra, tükürük

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Mandibuler ilerletme özelliğine sahip şeffaf hizalayıcıların farklı büyüme ve gelişim evrelerinde kullanımı farklı oranlarda iskeletsel ve dentoalveoler sonuçlar doğurmaktadır.

Invisalign MA, anterior dişlerin tork kontrolünü sağlamakta başarılı görünmektedir. Şeffaf hizalayıcılar, geleneksel fonksiyonel apareylerin kullanımında görülebilen üst keser retroklinasyonu ve alt keser proklinasyonunu sınırlandırabilmekte, böylece overjeti ve Sınıf II malokluzyonun iskeletsel düzeltimi için gerekli aktivasyon aralığını koruyabilmektedir.

Mandibuler ilerletme amacıyla yerleştirilen hassas kanatları içeren şeffaf hizalayıcıların yeni bir sistem olması sebebiyle çeşitli limitasyonları bulunmaktadır.

KAYNAKÇA

1. Franchi L, Baccetti T. Prediction of Individual Mandibular Changes Induced by Functional Jaw Orthopedics Followed by Fixed Appliances in Class II Patients. Angle Orthodontist [Internet]. 2006 [cited 2022 Nov 11];76(6). Available from: http://meridian.allenpress.com/angle-orthodontist/article-pdf/76/6/950/1381997/110205-385.pdf
2. Cozza P, Baccetti T, Franchi L, De Toffol L, McNamara JA. Mandibular changes produced by functional appliances in Class II malocclusion: A systematic review. American Journal of Orthodontics and Dentofacial Orthopedics. 2006 May 1;129(5):599.e1-599.e12.
3. Chen JY, Will LA, Niederman R. Analysis of efficacy of functional appliances on mandibular growth. American Journal of Orthodontics and Dentofacial Orthopedics. 2002 Nov 1;122(5):470–6.
4. Bucci R, Franchi L. Class II functional orthopaedic treatment: a systematic review of systematic reviews. 2015 [cited 2022 Nov 11]; Available from: https://onlinelibrary.wiley.com/doi/10.1111/joor.12295
5. Zhou L, Wang YM, Zhang L, Yao J. . West China Journal of Stomatology [Internet]. 2019 Jun 1 [cited 2022 Nov 11];37(3):236. Available from: /pmc/articles/PMC7030077/
6. Baldini A, Nota A, Santariello C, Caruso S, Assi V, Ballanti F, et al. Sagittal dentoskeletal modifications associated with different activation protocols of rapid maxillary expansion. Eur J Paediatr Dent. 2018 Jun;19(2):151–5.
7. Caruso S, Gatto R, Capogreco M, Nota A. Association of Visual Defects and Occlusal Molar Class in Children. Biomed Res Int. 2018 Jun 25;2018:1–4.
8. Marino A, Nota A, Caruso S, Gatto R, Malagola C, Tecco S. Obstructive sleep apnea severity and dental arches dimensions in children with late primary dentition: An observational study. Cranio. 2021 May;39(3):225–30.
9. Silvestrini-Biavati A, Migliorati M, Demarziani E, Tecco S, Silvestrini-Biavati P, Polimeni A, et al. Clinical association between teeth malocclusions, wrong posture and ocular convergence disorders: an epidemiological investigation on primary school children. BMC Pediatr. 2013 Jan 23;13:12.
10. Caruso S, Nota A, Ehsani S, Maddalone E, Ojima K, Tecco S. Impact of molar teeth distalization with clear aligners on occlusal vertical dimension: a retrospective study.

BMC Oral Health [Internet]. 2019 Aug 13 [cited 2022 Nov 23];19(1). Available from: https://pubmed.ncbi.nlm.nih.gov/31409348/
11. Caruso S, Storti E, Nota A, Ehsani S, Gatto R. Temporomandibular Joint Anatomy Assessed by CBCT Images. 2017 [cited 2022 Nov 23]; Available from: http://dx.doi.org/10.1155/2017/2916953
12. Spencer Sonntag Blackham DMD by. A study of short-term skeletal, dental, and soft tissue effects of Class II malocclusions treated with Invisalign with Mandibular Advancement Feature or Twin Block appliance compared with historical controls. 2020 [cited 2022 Nov 14]; Available from: https://open.library.ubc.ca/soa/cIRcle/collections/ubctheses/24/items/1.0392341
13. Pontes LF, Maia FA, Almeida MR, Flores-Mir C, Normando D. Mandibular Protraction Appliance Effects in Class II Malocclusion in Children, Adolescents and Young Adults. Braz Dent J [Internet]. 2017 Mar 1 [cited 2022 Nov 11];28(2):225–33. Available from: http://www.scielo.br/j/bdj/a/qxGYmCjhNq9ZFDHwyKHfKSm/abstract/?lang=en
14. Bishara SE, Ziaja RR. Functional appliances: a review. Am J Orthod Dentofacial Orthop. 1989 Mar;95(3):250–8.
15. McNamara JA. Orthodontic and orthopedic treatment in the mixed dentition. Brudon WL, Spivey KBradish, Skidmore LM, editors. Ann Arbor, Mich: Needham Press; 1993.
16. Nalbantgil D, Arun T, Sayinsu K, Fulya I. Skeletal, dental and soft-tissue changes induced by the Jasper Jumper appliance in late adolescence. Angle Orthod. 2005 May;75(3):426–36.
17. Liu C, Jiang S, Xie H, Bai M. Functional clear aligner technique in the treatment of class II malocclusion in juvenile: A case report and literature review. J Radiat Res Appl Sci. 2022 Sep;15(3):59–64.
18. MCNAMARA JR. JA. Components of Class II Malocclusion in Children 8–10 Years of Age. Angle Orthod [Internet]. 1981 Jul 1;51(3):177–202. Available from: https://doi.org/10.1043/0003-3219(1981)051<0177:COCIMI>2.0.CO
19. Pacha MM, Fleming PS, Johal A. A comparison of the efficacy of fixed versus removable functional appliances in children with Class II malocclusion: A systematic review. Eur J Orthod [Internet]. 2016 Dec 1 [cited 2022 Nov 11];38(6):621–30. Available from: https://academic.oup.com/ejo/article/38/6/621/2738995
20. Tulloch JF, Proffit WR, Phillips C. Influences on the outcome of early treatment for Class II malocclusion. Am J Orthod Dentofacial Orthop. 1997;111(5):533–42.
21. Giancotti A, Cozza P, Mampieri G. Aligners and Mandibular Advancement: A Comprehensive Option for Phase I Treatment of Class II, Division 1 Cases. J Clin Orthod. 2020 Sep;54(9):513–24.
22. Perinetti G, Primožič J, Franchi L, Contardo L. Treatment Effects of Removable Functional Appliances in Pre-Pubertal and Pubertal Class II Patients: A Systematic Review and Meta-Analysis of Controlled Studies. 2015 [cited 2022 Nov 11]; Available from: www.ncbi.nlm.nih.gov
23. Coben SE. The biology of Class II treatment. Am J Orthod. 1971 May;59(5):470–87.
24. Vig K. One- or two-phase orthodontic treatment for Class II malocclusion does not change the occlusal outcome. Journal of Evidence Based Dental Practice. 2004 Jun;4(2):142–3.

25. King GJ, Keeling SD, Hocevar RA, Wheeler TT. The timing of treatment for Class II malocclusions in children: a literature review. Angle Orthod. 1990;60(2):87–97.
26. West EE. Treatment objectives in the deciduous dentition. Am J Orthod. 1969 Jun;55(6):617–32.
27. Hägg U, Pancherz H. Dentofacial orthopaedics in relation to chronological age, growth period and skeletal development. An analysis of 72 male patients with Class II division 1 malocclusion treated with the Herbst appliance. Eur J Orthod. 1988 Aug;10(3):169–76.
28. Malmgren O, Omblus J, Hägg U, Pancherz H. Treatment with an orthopedic appliance system in relation to treatment intensity and growth periods. A study of initial effects. Am J Orthod Dentofacial Orthop. 1987 Feb;91(2):143–51.
29. Pfeiffer JP. Should orthopaedic treatment of severe class II malocclusions be related to growth? Eur J Orthod. 1980;2(4):249–56.
30. Hägg U, Taranger J. Menarche and voice change as indicators of the pubertal growth spurt. Acta Odontol Scand. 1980;38(3):179–86.
31. Lindgren G. Growth of schoolchildren with early, average and late ages of peak height velocity. Ann Hum Biol. 1978 May;5(3):253–67.
32. Marshall WA, Tanner JM. Variations in pattern of pubertal changes in girls. Arch Dis Child. 1969 Jun 1;44(235):291–303.
33. Onat T, Numan-Cebeci E. Sesamoid bones of the hand: relationships to growth, skeletal and sexual development in girls. Hum Biol. 1976 Dec;48(4):659–76.
34. Hägg U, Taranger J. Maturation indicators and the pubertal growth spurt. Am J Orthod. 1982 Oct;82(4):299–309.
35. O'Reilly MT, Yanniello GJ. Mandibular growth changes and maturation of cervical vertebrae--a longitudinal cephalometric study. Angle Orthod. 1988 Apr;58(2):179–84.
36. Seehra J, Fleming ; P S, Mandall ; N, Dibiase ; A T. A comparison of two different techniques for early correction of Class III malocclusion. [cited 2022 Nov 11]; Available from: http://meridian.allenpress.com/angle-orthodontist/article-pdf/82/1/96/2190423/032011-197_1.pdf
37. Vaid NR, Doshi VM, Vandekar MJ. Class II treatment with functional appliances: A meta-analysis of short-term treatment effects. Semin Orthod. 2014 Dec 1;20(4):324–38.
38. Moro A, Borges SW, Spada PP, Morais ND, Correr GM, Chaves CM, et al. Twenty-year clinical experience with fixed functional appliances. Dental Press J Orthod [Internet]. 2018 Mar 1 [cited 2022 Nov 11];23(2):87–109. Available from: http://www.scielo.br/j/dpjo/a/Y5LnY63y8GL7ZkvpdDXxtyj/abstract/?lang=en
39. Koukou M, Damanakis G, Tsolakis AI. Orthodontic Management of Skeletal Class II Malocclusion with the Invisalign Mandibular Advancement Feature Appliance: A Case Report and Review of the Literature. Case Rep Dent [Internet]. 2022 [cited 2022 Nov 14];2022. Available from: https://pubmed.ncbi.nlm.nih.gov/35601082/
40. Marsico E, Gatto E, Burrascano M, Matarese G, Cordasco G. Effectiveness of orthodontic treatment with functional appliances on mandibular growth in the short term. American Journal of Orthodontics and Dentofacial Orthopedics. 2011 Jan;139(1):24–36.

41. Ravera S, Castroflorio T, Galati F, Cugliari G, Garino F, Deregibus A, et al. Short term dentoskeletal effects of mandibular advancement clear aligners in Class II growing patients. A prospective controlled study according to STROBE Guidelines. Eur J Paediatr Dent [Internet]. 2021 [cited 2022 Nov 14];22(2):119–24. Available from: https://pubmed.ncbi.nlm.nih.gov/34238001/
42. https://cloud.news.aligntech.com/ma-faq.
43. Caruso S, Nota A, Caruso S, Severino M, Gatto R, Meuli S, et al. Mandibular advancement with clear aligners in the treatment of skeletal Class II. A retrospective controlled study. Eur J Paediatr Dent [Internet]. 2021 Jan 1 [cited 2022 Nov 11];22(1):26–30. Available from: https://europepmc.org/article/MED/33719479
44. Sabouni W, Hansa I, Ali SM Al, Adel SM, Vaid N, Sabouni W, et al. Invisalign treatment with mandibular advancement: A retrospective cohort cephalometric appraisal. J Clin Imaging Sci [Internet]. 2022 Jul 29 [cited 2022 Nov 11];12:42. Available from: https://clinicalimagingscience.org/invisalign-treatment-with-mandibular-advancement-a-retrospective-cohort-cephalometric-appraisal
45. Morton J, Derakhshan M, Kaza S, Li C. Design of the Invisalign system performance. Semin Orthod. 2017 Mar;23(1):3–11.
46. Sessle BJ, Woodside DG, Bourque P, Gurza S, Powell G, Voudouris J, et al. Effect of functional appliances on jaw muscle activity. American Journal of Orthodontics and Dentofacial Orthopedics. 1990 Sep;98(3):222–30.
47. Voudouris JC, Voudouris JD, Nicolay O, Glaser B, Nicozisis J, Theodoridis G, et al. Clear aligners, dentofacial orthopedics, physics and supercorrection prescription biomechanics. A meeting of the minds. Semin Orthod. 2022 Jan;27(4):202–58.
48. Moya SP, Zafra JL. Aligner Techniques in Orthodontics. Wiley; 2021.
49. Zybutz T, Drummond R, Lekic M, Brownlee M. Investigation and comparison of patient experiences with removable functional appliances: Invisalign Teen with Mandibular Advancement versus Twin Block. [cited 2022 Nov 11]; Available from: http://meridian.allenpress.com/angle-orthodontist/article-pdf/91/4/490/2854452/i0003-3219-91-4-490.pdf
50. Phan X, Ling PH. Clinical limitations of Invisalign. J Can Dent Assoc. 2007 Apr;73(3):263–6.
51. Koretsi V, Zymperdikas VF, Papageorgiou SN, Papadopoulos MA. Treatment effects of removable functional appliances in patients with Class II malocclusion: a systematic review and meta-analysis. Eur J Orthod. 2015 Aug;37(4):418–34.
52. Glaser B. Invisalign treatment with mandibular advancement – a review of the North American study. Los Angeles (CA): American Association of Orthodontists Annual Session; May 4, 2019.
53. Lombardo EC, Lione R, Franchi L, Gaffuri F, Maspero C, Cozza P, et al. Dentoskeletal effects of clear aligner vs twin block—a short-term study of functional appliances. Journal of Orofacial Orthopedics / Fortschritte der Kieferorthopädie. 2023 Jan 18;
54. Mills CM, McCulloch KJ. Posttreatment changes after successful correction of Class II malocclusions with the twin block appliance. Am J Orthod Dentofacial Orthop. 2000 Jul;118(1):24–33.
55. Wu Y, Yu Q, Xia Y, Wang B, Chen S, Gu K, et al. Does mandibular advancement with clear aligners have the same skeletal and dentoalveolar effects as traditional functional appliances? BMC Oral Health. 2023 Feb 2;23(1):65.

56. Al-Moghrabi D, Salazar FC, Pandis N, Fleming PS. Compliance with removable orthodontic appliances and adjuncts: A systematic review and meta-analysis. American Journal of Orthodontics and Dentofacial Orthopedics. 2017 Jul 1;152(1):17–32.

Bölüm 3

ORTOGNATİK CERRAHİDE DİJİTAL İŞ AKIŞI

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GİRİŞ

Yüz iskeleti, dişler ve yumuşak doku ortodontik tedavi planlamasında belirleyici rol oynayan üç önemli doku grubudur. Dentofasiyal deformitesi olan hastalarda bu üç dokunun birbirleriyle olan ilişkisi ve bağımlılığının dikkatli bir şekilde değerlendirilmesi gerekmektedir. Yüz yıldan fazla süredir bu analizlerin en doğru şekilde yapılabilmesi için analog teknikler, dijital teknikler ve görüntü füzyon modelleri olarak tanımlanan görüntüleme teknikleri geliştirilmiştir (1).

Analog teknik, preoperatif olarak osteotominin alçı modeller üzerinde uygulanmasıyla postoperatif oklüzyonun planlamasını amaçlamaktadır. Ancak bu teknik yalnızca oklüzyona odaklanarak yumuşak dokuları göz ardı etmekte ve iyi bir fonksiyon elde edilse de kötü bir estetikle sonuçlanabilmektedir. 1970'li ve 1980'li yıllarda, oklüzyon kadar estetik de önemsenmeye başlanmıştır. Sefalogramların gelişmesiyle tedavi planlamalarında oklüzyonla birlikte profil de analiz edilmeye başlanmış ve kısa sürede sefalometrik filmler ortodontik tedavi ve ortognatik cerrahinin planlanmasında altın standart olarak kabul edilmiştir (2).

Dijital fotoğrafçılığın ve iki boyutlu bilgisayar yazılımlarının gelişmesiyle dijital tekniklerde ilerleme sağlanmıştır. Ancak iki boyutlu analiz, deformiteleri hacimsel olarak değerlendiremediğinden ve sert ve yumuşak doku üzerindeki noktaları doğru bir şekilde belirlemenin zorluğundan kaynaklanan hatalardan dolayı yetersiz kalmaktadır (3). Bu tekniklerin yetersizlikleri nedeniyle yumuşak dokunun da görüntülenebilmesi için üç boyutlu fotoğraf, video ve lazer tarama tekniklerinde gelişmeler başlamıştır ve 1980'lerin sonunda üç boyutlu sanal planlama yazılım programları tanıtılmıştır (4). 2000'lerin başında bu yazılımlardaki önemli gelişmelerle DICOM dosyaları sanal ameliyathane olarak

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Hasta memnuniyetinin iki grupta olumlu olduğu, ancak 3D planlama grubunda daha fazla hastanın çok memnun olduğunu bildirdiği belirtilmiştir (34).

Bilgisayar destekli cerrahi planlama ile analog model cerrahisi ile planlamanın hastaların ameliyat sonrası memnuniyetini etkileyip etkilemediğini belirlemeyi amaçlayan bir çalışmada 6 yıllık bir süre içinde ortognatik cerrahi uygulanmış tüm hastalara standartlaştırılmış bir anket doldurtulmuştur. Çalışmanın sonucunda ameliyat planlaması dijital olarak yapılan hastaların ameliyat sonrası görünümlerinden ve cerrahi kararlarından önemli ölçüde daha fazla memnun oldukları bulunmuştur (35).

SONUÇ

Bütün avantajlarıyla birlikte sanal planlamanın, üç boyutlu verilerin iki boyutlu bir ekranda görüntülenmesi ve manipüle edilmesinin sınırlı olması sebebiyle bazı hatalara yol açabileceği bilinmeli ve sanal hasta modellerinin, doğruluklarının onaylandığı birçok çalışmaya rağmen bu verilerin dokuların statik bir temsili olduğu unutulmamalıdır. Bu nedenle, hassas ortognatik cerrahi planlaması için son derece değerli dinamik bilgiler elde etmek amacıyla ayrıntılı fizik muayene kesinlikle gereklidir.

KAYNAKÇA

1. Angle E. Double resection of the lower maxilla. *Dental Cosmos*. 1898; 40.
2. Sarvera DM, Ackermanb JL. Orthodontics about face: the re-emergence of the esthetic paradigm. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2000;117(5): 575-576.
3. Swennen GRJ, Schutyser F, Barth EL, et al. A new method of 3-D cephalometry Part I: the anatomic Cartesian 3D reference system. *Journal of Craniofacial Surgery.* 2006;17(2): 314-325.
4. Burk Jr, Dana CM, Cooperstein LA, et al. Acetabular fractures: three-dimensional computed tomographic imaging and interactive surgical planning. *Journal of Computed Tomography.* 1986;10(1): 1-10.
5. Schutyser F., van Cleynenbreugel J, Ferrant M, et al. Image-based 3D planning of maxillofacial distraction procedures including soft tissue implications. In: *3 nd International Conference Medical Image Computing and Computer-Assisted Intervention* (MICCAI 2000), 11-14 October 2000, Pittsburgh, PA, USA, Proceedings 3, Springer.
6. Lin HH, Lo LJ. Three-dimensional computer-assisted surgical simulation and intraoperative navigation in orthognathic surgery: a literature review. *Journal of the Formosan Medical Association. 2015;*114(4): 300-307.
7. Lo LJ, Weng JL, Ho CT, et al. Three-dimensional region-based study on the relationship between soft and hard tissue changes after orthognathic surgery in patients with prognathism. 2018;*PLoS One* 13(8): e0200589.
8. Arnett GW, Jelic JS, Kim J, et al. Soft tissue cephalometric analysis: diagnosis and treat-

ment planning of dentofacial deformity. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1999;116(3): 239-253.
9. Lundström A, Lundström F, Lebret LML, et al. Natural head position and natural head orientation: basic considerations in cephalometric analysis and research.*European Journal of Orthodontics. 1995;* 17(2): 111-120.
10. Brüllmann D, Schulze R. Spatial resolution in CBCT machines for dental/maxillofacial applications—what do we know today? *Dentomaxillofacial Radiology. 2015;* 44(1): 20140204.
11. Nkenke E, Zachow S, Benz M, et al. Fusion of computed tomography data and optical 3D images of the dentition for streak artefact correction in the simulation of orthognathic surgery. *Dentomaxillofacial Radiology. 2004;* 33(4): 226-232.
12. Maes F, Collignon A, Vandermeulen D, et al. Multimodality image registration by maximization of mutual information. *IEEE Transactions on Medical Imaging. 1997;*16: 187–198.
13. Plooij JM, Maal TJJ, Haers P, et al. Digital three-dimensional image fusion processes for planning and evaluating orthodontics and orthognathic surgery. A systematic review. *International Journal of Oral and Maxillofacial Surgery. 2011;* 40: 341–352.
14. Pelizzari CA, Grzeszczuk R, Chen GTY, et al. Volumetric visualization of anatomy for treatment planning. *International Journal of Radiation Oncology* Biology* Physics. 1994;*30: 186.
15. Yushkevich PA, Piven J, Hazlett HC, et al. User-guided 3D active contour segmentation of anatomical structures: significantly improved efficiency and reliability." *Neuroimage. 2006;*31(3): 1116-1128
16. Xia JJ, Gateno J, Teichgraeber JF, et al. Three-dimensional computer-aided surgical simulation for maxillofacial surgery. *Atlas of the oral and maxillofacial surgery clinics of North America*. 2005;13(1): 25-39.
17. Lin HH, Lonic D, Lo LJ, et al. 3D printing in orthognathic surgery– A literature review. *Journal of the Formosan Medical Association*. 2018;117(7): 547-558.
18. Kim D, Ho DCY, Mai H, et al. A clinically validated prediction method for facial soft-tissue changes following double-jaw surgery. *Medical physics. 2017;*44(8): 4252-4261.
19. Jones RM, Khambay BS, McHugh S, et al. The validity of a computer-assisted simulation system for orthognathic surgery (CASSOS) for planning the surgical correction of class III skeletal deformities: single-jaw versus bimaxillary surgery. *International journal of oral and maxillofacial surgery.* 2007;36(10): 900-908.
20. Shafi M, Ayoub A, Ju X, et al. The accuracy of three-dimensional prediction planning for the surgical correction of facial deformities using Maxilim. *International Journal of Oral and Maxillofacial Surgery. 2013;*42(7): 801-806.
21. van Twisk PH, Tenhagen M, Gül A, et al. How accurate is the soft tissue prediction of Dolphin Imaging for orthognathic surgery? *International Orthodontics. 2019;*17(3): 488-496.
22. de Britto Teixeira AO, de Oliveira Almeida MA, da Cunha Almeida RC,et al. Three-dimensional accuracy of virtual planning in orthognathic surgery. *American Journal of Orthodontics and Dentofacial Orthopedics*. 158(5): 674-683.
23. Zhang N, Liu S, Hu Z, et al. Accuracy of virtual surgical planning in two-jaw orthognathic surgery: comparison of planned and actual results. *Oral surgery, oral medicine, oral pathology and oral radiology. 2016;*122(2): 143-151.

24. Resnick C, Dang R, Glick s, et al. Accuracy of three-dimensional soft tissue prediction for Le Fort I osteotomy using Dolphin 3D software: a pilot study. *International Journal of Oral and Maxillofacial Surgery.* 2017; 46(3): 289-295.
25. Peterman RJ, Jiang S, Johe R, et al. Accuracy of Dolphin visual treatment objective (VTO) prediction software on class III patients treated with maxillary advancement and mandibular setback. *Progress in Orthodontics*. 2016;17:1-9.
26. Pektas ZÖ, Kircelli BH, Cilasun Ü, et al. The accuracy of computer-assisted surgical planning in soft tissue prediction following orthognathic surgery. *The International Journal of Medical Robotics and Computer Assisted Surgery. 2007;*3(1): 64-71.
27. Vale F, Scherzberg J, Cavaleiro J, et al. 3D virtual planning in orthognathic surgery and CAD/CAM surgical splints generation in one patient with craniofacial microsomia: a case report. *Dental Press Journal of Orthodontics*. 2016;21: 89-100.
28. Park JH, Papademetriou M, Gardiner C, et al. Anterior open bite correction with 2-jaw orthognathic surgery. *American Journal of Orthodontics and Dentofacial Orthopedic*s. 2019;155(1): 108-116. e102.
29. Onică N, Tatarciuc M, Baciu ER, et al. Managing Predicted Post-Orthognathic Surgical Defects Using Combined Digital Software: A Case Report. *Healthcare* 2023;*11*(9):1219
30. Liebregts J, Xi T, Timmermans M, et al. Accuracy of three-dimensional soft tissue simulation in bimaxillary osteotomies. *Journal of CranioMaxillofacial Surgery.* 2015; 43(3): 329-335.
31. Mundluru T, Almukhtar A, Ju X et al. The accuracy of three-dimensional prediction of soft tissue changes following the surgical correction of facial asymmetry: An innovative concept. *International journal of oral and maxillofacial surgery.* 2017; 46(11): 1517-1524.
32. De Riu G, Virdis PI, Meloni SM, et al. Accuracy of computer-assisted orthognathic surgery. Journal of *CranioMaxillofacial Surgery.* 2018; 46(2): 293-298.
33. Morris RS, Hoye LN, Elnagar MH, et al. Accuracy of Dental Monitoring 3D digital dental models using photograph and video mode. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2019; 156(3): 420-428.
34. Wu TY, Lin HH, Lo LJ, et al. Postoperative outcomes of two-and three-dimensional planning in orthognathic surgery: a comparative study. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2017; 70(8): 1101-1111.
35. Bueno S, Hammad Y, Schlieve T, et al. Does the type of planning in orthognathic surgery influence patient satisfaction? *Oral and Maxillofacial Surgery.* 2022;1-8.
36. Elnagar M. H., et al. (2020). "Digital workflow for combined orthodontics and orthognathic surgery." *Oral and Maxillofacial Surgery Clinics. 2020;* 32(1): 1-14.

Bölüm 4

ORTODONTİK TEDAVİDEKİ KOMPLİKASYONLARA GÜNCEL BİR BAKIŞ

Berk SÜM[1]
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1. GİRİŞ

Her medikal tedavinin avantajları, dezavantajları, riskleri ve komplikasyonları vardır. Bunlar prognozu, tedavi planını ve tedavinin genel kalitesini etkilemektedir. Ortodontik tedavi için de bu durum geçerlidir. Her ne kadar cerrahi branşlardaki kadar yüksek olmasa da ortodonti branşında da geniş bir komplikasyon yelpazesi mevcuttur. Bunun sebebi, aparey ve materyal çeşitliliğinden, aktif tedavi süresinden, tedavi alternatifi çeşitliliğinden ve hasta grubunun geniş yaş aralığından kaynaklanmaktadır. Hastanın tedavisine başlamadan önce risk faktörleri ve olası komplikasyonlar, hastaya özel olarak değerlendirilmeli ve zarar-yarar dengesi göz önüne alınarak tedaviye başlamaya karar verilmelidir.

Komplikasyonların yaşanmasının önüne geçmek için ilgili konuya hakim olmak, detaylı bir tedavi planı hazırlamak, tedavi planını dikkatlice uygulamak ve hastayı sorumlulukları hakkında iyi bilgilendirmek gerekmektedir. Yine de komplikasyonlar, bütün branşlardan hekimlerin başına gelebilmektedir. Hekimin gerekli tedbirleri tedavi öncesinde almasından bağımsız olarak, meydana gelmiş komplikasyona da doğru müdahale edebilmelidir.

Kökeni Fransızcadan gelen ve karmaşıklık anlamında olan komplikasyonlar, ortodontide; lokal, sistemik ve diğer olmak üzere üç ana başlık altında sınıflandırılabilir.

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4.3 Hastanın Tedaviye Uyum Göstermemesi

Ortodontik tedavinin süresi ve başarısı mekanik faktörlerin yanı sıra hastanın uyumuna, motivasyonuna ve kooperasyonuna bağlıdır (157). Qabool ve ark. (157), ortodontik tedavi süreci boyunca farklı aşamalarda kooperasyonun ve uyumun değiştiğini belirtmektedir. Kooperasyonun seviyeleme aşamalarında yüksek iken boşluk kapama aşamasında düşmeye başladığını ve tedavi bitene kadar da düşmeye devam ettiğini belirtmişlerdir.

5. SONUÇ

Görüldüğü gibi ortodontik tedavilerde çeşitli komplikasyonlar mevcuttur. Ortodonti de diş hekimliğinin tüm alanlarında olduğu gibi sürekli değişmekte ve gelişmektedir. Her yeni metot, malzeme ve teknolojinin entegre olmasıyla yeni tedavi opsiyonları ve bununla birlikte daha farklı komplikasyonlar da oluşmaktadır. Her branşta olduğu gibi aktif çalışan her hekim komplikasyonlarla karşılaşacaktır. Hekim bu komplikasyonlarla karşılaşmadan önce gerekli önlemleri almalı ve karşılaştıktan sonra da durumun yönetimini en doğru şekilde yapacak şekilde bilgi sahibi olmalıdır.

6. KAYNAKÇA

1. Richter AE, Arruda AO, Peters MC, Sohn W. Incidence of caries lesions among patients treated with comprehensive orthodontics. Am J Orthod Dentofacial Orthop. 2011 May;139(5):657–64.
2. Chapman JA, Roberts WE, Eckert GJ, Kula KS, González-Cabezas C. Risk factors for incidence and severity of white spot lesions during treatment with fixed orthodontic appliances. Am J Orthod Dentofacial Orthop. 2010 Aug; 138(2):188–94.
3. Khoroushi M, Kachuie M. Prevention and Treatment of White Spot Lesions in Orthodontic Patients. Contemp Clin Dent. 2017 Jan 1; 8(1):11–9.
4. Boersma JG, Van Der Veen MH, Lagerweij MD, Bokhout B, Prahl-Andersen B. Caries prevalence measured with QLF after treatment with fixed orthodontic appliances: influencing factors. Caries Res. 2005; 39(1):41–7.
5. Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. Am J Orthod. 1982; 81(2):93–8.
6. Heymann GC, Grauer D. A contemporary review of white spot lesions in orthodontics. J Esthet Restor Dent. 2013 Apr; 25(2):85–95.
7. Chang HS, Walsh LJ, Freer TJ. Enamel demineralization during orthodontic treatment. Aetiology and prevention. Aust Dent J. 1997 Oct; 42(5):322–7.
8. Rossini G, Parrini S, Castroflorio T, Deregibus A, Debernardi CL. Efficacy of clear aligners in controlling orthodontic tooth movement: a systematic review. Angle Orthod. 2015 Sep 1; 85(5):881–9.
9. Albhaisi Z, Al-Khateeb SN, Abu Alhaija ES. Enamel demineralization during clear aligner orthodontic treatment compared with fixed appliance therapy, evaluated with

quantitative light-induced fluorescence: A randomized clinical trial. Am J Orthod Dentofacial Orthop. 2020 May 1; 157(5):594–601.
10. Moshiri M, Eckhart JE, McShane P, German DS. Consequences of poor oral hygiene during aligner therapy. J Clin Orthod. 2013; 47(8):494–8
11. Buschang PH, Chastain D, Keylor CL, Crosby D, Julien KC. Incidence of white spot lesions among patients treated with clear aligners and traditional braces. Angle Orthod. 2019; 89(3):359–64.
12. Zahradnik RT, Magnusson I, Walker C, McDonell E, Hillman CH, Hillman JD. Preliminary assessment of safety and effectiveness in humans of ProBiora3, a probiotic mouthwash. J Appl Microbiol. 2009 Aug; 107(2):682–90.
13. Denis M, Atlan A, Vennat E, Tirlet G, Attal JP. White defects on enamel: diagnosis and anatomopathology: two essential factors for proper treatment (part 1). Int Orthod. 2013 Jun; 11(2):139–65.
14. Perdigão J. Resin infiltration of enamel white spot lesions: An ultramorphological analysis. Journal of esthetic and restorative dentistry. 2020 Apr 1;32(3):317–24.
15. Kidd EAM, Fejerskov O. What constitutes dental caries? Histopathology of carious enamel and dentin related to the action of cariogenic biofilms. J Dent Res. 2004 Jan
16. Meyer-Lueckel H, Paris S, Kielbassa AM. Surface layer erosion of natural caries lesions with phosphoric and hydrochloric acid gels in preparation for resin infiltration. Caries Res. 2007 Apr; 41(3):223–30.
17. Yuan H, Li J, Chen L, Cheng L, Cannon RD, Mei L. Esthetic comparison of white-spot lesion treatment modalities using spectrometry and fluorescence. Angle Orthod. 2014 Mar; 84(2):343–9.
18. Hodges SJ, Spencer RJ, Watkins SJ. Unusual indelible enamel staining following fixed appliance treatment. J Orthod. 2000 Dec; 27(4):303–6.
19. Kamber R, Papageorgiou SN, Eliades T. Does orthodontic treatment have a permanent effect on tooth color? : A systematic review and meta-analysis. Journal of Orofacial Orthopedics. 2018 Mar 1; 79(2):73–82.
20. Pinzan-Vercelino CRM, Souza Costa AC, Gurgel JA, Salvatore Freitas KM. Comparison of enamel surface roughness and color alteration after bracket debonding and polishing with 2 systems: A split-mouth clinical trial. Am J Orthod Dentofacial Orthop. 2021 Nov 1; 160(5):686–94.
21. Eliades T, Kakaboura A, Eliades G, Bradley TG. Comparison of enamel colour changes associated with orthodontic bonding using two different adhesives. Eur J Orthod. 2001; 23(1):85–90.
22. Inokoshi S, Burrow M, Kataumi M, Yamada T, Takatsu T. Opacity and color changes of tooth-colored restorative materials. Oper Dent. 1996;
23. Karamouzos A, Athanasiou AE, Papadopoulos MA, Kolokithas G. Tooth-color assessment after orthodontic treatment: a prospective clinical trial. Am J Orthod Dentofacial Orthop. 2010; 138(5):537.e1-537.e8.
24. Barwick PJ, Ramsay DS. Effect of brief intrusive force on human pulpal blood flow. Am J Orthod Dentofacial Orthop. 1996; 110(3):273–9.
25. Mcdonald F, Pitt Ford TR. Blood flow changes in permanent maxillary canines during retraction. Eur J Orthod. 1994 Feb; 16(1):1–9.
26. Baik UB, Kim H, Chae HS, Myung JY, Chun YS. Teeth discoloration during orthodontic treatment. The Korean Journal of Orthodontics. 2017 Jul 27; 47(5):334–9.

27. Boncuk Y, Çehreli ZC, Polat-Özsoy Ö. Effects of different orthodontic adhesives and resin removal techniques on enamel color alteration. Angle Orthod. 2014; 84(4):634–41.
28. Dumbryte I, Linkeviciene L, Linkevicius T, Malinauskas M. Does orthodontic debonding lead to tooth sensitivity? Comparison of teeth with and without visible enamel microcracks. Am J Orthod Dentofacial Orthop. 2017 Feb 1; 151(2):284–91.
29. Arhun N, Arman A. Effects of Orthodontic Mechanics on Tooth Enamel: A Review. Semin Orthod. 2007 Dec 1;13(4):281–91.
30. Dumbryte I, Vebriene J, Linkeviciene L, Malinauskas M. Enamel microcracks in the form of tooth damage during orthodontic debonding: a systematic review and meta-analysis of in vitro studies. Eur J Orthod. 2018 Nov 30; 40(6):636–48.
31. Yassaei S, Soleimanian A, Nik ZE. Effects of Diode Laser Debonding of Ceramic Brackets on Enamel Surface and Pulpal Temperature. J Contemp Dent Pract. 2015 Apr 1; 16(4):270–4.
32. Bishara SE, Trulove TS. Comparisons of different debonding techniques for ceramic brackets: an in vitro study. Part II. Findings and clinical implications. American journal of orthodontics and dentofacial orthopedics. 1990; 98(3):263–73.
33. Han G, Hu M, Zhang Y, Jiang H. Pulp vitality and histologic changes in human dental pulp after the application of moderate and severe intrusive orthodontic forces. Am J Orthod Dentofacial Orthop. 2013 Oct; 144(4):518–22.
34. Javed F, Al-Kheraif AA, Romanos EB, Romanos GE. Influence of orthodontic forces on human dental pulp: a systematic review. Arch Oral Biol. 2015; 60(2):347–56.
35. Ramazanzadeh BA, Sahhafian AA, Mohtasham N, Hassanzadeh N, Jahanbin A, Shakeri MT. Histological changes in human dental pulp following application of intrusive and extrusive orthodontic forces. J Oral Sci. 2009 Mar 3; 51(1):109–15.
36. Holst AI, Karl M, Karolczak M, Goellner M, Holst S. Quantitative assessment of orthodontic mini-implant displacement: the effect of initial force application. Quintessence Int. 2010 Jan; 41(1):59–66.
37. Derringer KA, Linden RWA. Angiogenic growth factors released in human dental pulp following orthodontic force. Arch Oral Biol. 2003 Apr 1; 48(4):285–91.
38. Derringer K, Linden R. Epidermal growth factor released in human dental pulp following orthodontic force. Eur J Orthod. 2007 Feb; 29(1):67–71
39. Derringer KA, Jaggers DC, Linden RWA. Angiogenesis in human dental pulp following orthodontic tooth movement. J Dent Res. 1996; 75(10):1761–6.
40. Lund H, Gröndahl K, Hansen K, Gröndahl HG. Apical root resorption during orthodontic treatment: A prospective study using cone beam CT. Angle Orthod. 2012 May 1; 82(3):480–7.
41. Nieto-Nieto N, Solano JE, Yañez-Vico R. External apical root resorption concurrent with orthodontic forces: the genetic influence. Acta Odontol Scand. 2017 May 19; 75(4):280–7
42. Samandara A, Papageorgiou SN, Ioannidou-Marathiotou I, Kavvadia-Tsatala S, Papadopoulos MA. Evaluation of orthodontically induced external root resorption following orthodontic treatment using cone beam computed tomography (CBCT): a systematic review and meta-analysis. Eur J Orthod. 2019 Jan 23; 41(1):67–79.
43. Al-Qawasmi RA, Hartsfield JK, Everett ET, Flury L, Liu L, Foroud TM, et al. Genetic predisposition to external apical root resorption. American Journal of Orthodontics and Dentofacial Orthopedics. 2003 Mar 1;123(3):242–52.

44. Guo Y, He S, Gu T, Liu Y, Chen S. Genetic and clinical risk factors of root resorption associated with orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 2016 Aug 1;150(2):283–9.
45. Brezniak N, Wasserstein A. Orthodontically induced inflammatory root resorption. Part II: The clinical aspects. Angle Orthod. 2002 Apr; 72(2):180–4
46. Hartsfield JK, Everett ET, Al-Qawasmi RA. Genetic factors in external apical root resorption and orthodontic treatment. Critical Reviews in Oral Biology and Medicine. 2004 Mar 1; 15(2):115–22.
47. Aman C, Azevedo B, Bednar E, Chandiramami S, German D, Nicholson E, et al. Apical root resorption during orthodontic treatment with clear aligners: A retrospective study using cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2018 Jun 1; 153(6):842–51
48. Baumrind S, Korn EL, Boyd RL. Apical root resorption in orthodontically treated adults. American Journal of Orthodontics and Dentofacial Orthopedics. 1996 Sep 1;110(3):311–20.
49. Vlaskalic V, Boyd RL, Baumrind S. Etiology and sequelae of root resorption. Semin Orthod. 1998 Jun 1;4(2):124–31.
50. Robert W. DeShields. A Study of Root Resorption in Treated Class II, Division I Malocclusions. Angle Orthod. 1969 Oct 1; 39(4)
51. Sameshima GT, Sinclair PM. Predicting and preventing root resorption: Part I. Diagnostic factors. American Journal of Orthodontics and Dentofacial Orthopedics. 2001 May 1;119(5):505–10.
52. Brezniak N, Wasserstein A. Root resorption after orthodontic treatment: Part 2. Literature review. American journal of orthodontics and dentofacial orthopedics 1993; 103(2):138–46.
53. Apajalahti S, Peltola JS. Apical root resorption after orthodontic treatment -- a retrospective study. Eur J Orthod. 2007 Aug; 29(4):408–12.
54. Arita K, Hotokezaka H, Hashimoto M, Nakano-Tajima T, Kurohama T, Kondo T, et al. Effects of diabetes on tooth movement and root resorption after orthodontic force application in rats. Orthod Craniofac Res. 2016 May 1; 19(2):83–92.
55. Oyama K, Motoyoshi M, Hirabayashi M, Hosoi K, Shimizu N. Effects of root morphology on stress distribution at the root apex. Eur J Orthod. 2007 Apr; 29(2):113–7.
56. Malmgren O, Goldson L, Hill C, Orwin A, Petrini L, Lundberg M. Root resorption after orthodontic treatment of traumatized teeth. Am J Orthod. 1982; 82(6):487–91.
57. Brin I, Ben-Bassat Y, Heling I, Engelberg A. The influence of orthodontic treatment on previously traumatized permanent incisors. Eur J Orthod. 1991 Oct; 13(5):372–7.
58. Casa MA, Faltin RM, Faltin K, Sander FG, Arana-Chavez VE. Root resorptions in upper first premolars after application of continuous torque moment. Intra-individual study. Journal of orofacial orthopedics = Fortschritte der Kieferorthopädie. 200; 62(4):285–95.
59. Taithongchai R, Sookkorn K, Killiany DM. Facial and dentoalveolar structure and the prediction of apical root shortening. Am J Orthod Dentofacial Orthop. 1996; 110(3):296–302.
60. Sameshima GT, Sinclair PM. Predicting and preventing root resorption: Part II. Treatment factors. American journal of orthodontics and dentofacial orthopedics. 2001; 119(5):511–5.

61. Pamukçu H, Polat-Özsoy Ö, Gülşahi A, Özemre MÖ. External apical root resorption after nonextraction orthodontic treatment with labial vs. lingual fixed appliances. J Orofac Orthop. 2020 Jan 1; 81(1):41–51.
62. Blake M, Woodside DG, Pharoah MJ. A radiographic comparison of apical root resorption after orthodontic treatment with the edgewise and Speed appliances. American journal of orthodontics and dentofacial orthopedics. 1995; 108(1):76–84.
63. Chen W, Haq AAA, Zhou Y. Root resorption of self-ligating and conventional preadjusted brackets in severe anterior crowding Class I patients: a longitudinal retrospective study. BMC Oral Health. 2015 Oct 1; 15(1).
64. Jacobs C, Gebhardt PF, Jacobs V, Hechtner M, Meila D, Wehrbein H. Root resorption, treatment time and extraction rate during orthodontic treatment with self-ligating and conventional brackets. Head Face Med. 2014 Jan 23; 10(1).
65. Kawashima-Ichinomiya R, Yamaguchi M, Tanimoto Y, Asano M, Yamada K, Nakajima R, et al. External apical root resorption and the release of interleukin-6 in the gingival crevucular fluid induced by a self-ligating system. Open J Stomatol. 2012 Jun 12; 2(2):116–21.
66. Brezniak N, Wasserstein A. Root Resorption Following Treatment with Aligners. Angle Orthod. 2008 Nov 1; 78(6):1119–24.
67. Fang X, Qi R, Liu C. Root resorption in orthodontic treatment with clear aligners: A systematic review and meta-analysis. Orthod Craniofac Res. 2019 Nov 1; 22(4):259–69.
68. Gandhi V, Mehta S, Gauthier M, Mu J, Kuo CL, Nanda R, et al. Comparison of external apical root resorption with clear aligners and pre-adjusted edgewise appliances in non-extraction cases: a systematic review and meta-analysis. Eur J Orthod. 2021 Feb 1; 43(1):15–24
69. Guangli Han; Shengfu Huang; Johannes W. Von den Hoff; Xianglong Zeng; Anne Marie Kuijpers-Jagtman. Root resorption after orthodontic intrusion and extrusion: An intraindividual study. Angle Orthod. 2005 Dec; 75(6).
70. Yamaguchi M, Fukasawa S. Is Inflammation a Friend or Foe for Orthodontic Treatment?: Inflammation in Orthodontically Induced Inflammatory Root Resorption and Accelerating Tooth Movement. Int J Mol Sci. 2021 Mar 1; 22(5):1–21.
71. Jiménez Montenegro VC, Jones A, Petocz P, Gonzales C, Darendeliler MA. Physical properties of root cementum: Part 22. Root resorption after the application of light and heavy extrusive orthodontic forces: a microcomputed tomography study. Am J Orthod Dentofacial Orthop. 2012; 141(1):e1.
72. Ballard DJ, Jones AS, Petocz P, Darendeliler MA. Physical properties of root cementum: part 11. Continuous vs intermittent controlled orthodontic forces on root resorption. A microcomputed-tomography study. Am J Orthod Dentofacial Orthop. 2009; 136(1):8.e1-8.e8.
73. Lombardo L, Bragazzi R, Perissinotto C, Mirabella D, Siciliani G. Cone-beam computed tomography evaluation of periodontal and bone support loss in extraction cases. Prog Orthod. 2013; 14(1).
74. Proffit, W.R., Fields, H.W., Larson, B. and Sarver DM. Contemporary Orthodontic (proffit, 2019). Contemporary orthodontics-e-book Elsevier Health Sciences. 2019;5–24.

75. Antoszewska-Smith J, Sarul M, Łyczek J, Konopka T, Kawala B. Effectiveness of orthodontic miniscrew implants in anchorage reinforcement during en-masse retraction: A systematic review and meta-analysis. Am J Orthod Dentofacial Orthop. 2017 Mar 1; 151(3):440–55.
76. Lin L, Ahn HW, Kim SJ, Moon SC, Kim SH, Nelson G. Tooth-borne vs bone-borne rapid maxillary expanders in late adolescence. Angle Orthod. 2015 Mar 1; 85(2):253–62
77. Papadopoulos MA, Papageorgiou SN, Zogakis IP. Clinical effectiveness of orthodontic miniscrew implants: a meta-analysis. J Dent Res. 2011 Aug; 90(8):969–76.
78. Jones JP, Elnagar MH, Perez DE. Temporary Skeletal Anchorage Techniques. Oral Maxillofac Surg Clin North Am. 2020 Feb 1; 32(1):27–37.
79. Inchingolo AM, Malcangi G, Costa S, Fatone MC, Avantario P, Campanelli M, et al. Tooth Complications after Orthodontic Miniscrews Insertion. Int J Environ Res Public Health. 2023 Jan 1; 20(2).
80. Kuroda S, Yamada K, Deguchi T, Hashimoto T, Kyung HM, Yamamoto TT. Root proximity is a major factor for screw failure in orthodontic anchorage. Am J Orthod Dentofacial Orthop. 2007 Apr; 131(4 Suppl).
81. Kuroda S, Sugawara Y, Deguchi T, Kyung HM, Takano-Yamamoto T. Clinical use of miniscrew implants as orthodontic anchorage: success rates and postoperative discomfort. Am J Orthod Dentofacial Orthop. 2007 Jan; 131(1):9–15.
82. Giudice A Lo, Rustico L, Longo M, Oteri G, Papadopoulos MA, Nucera R. Complications reported with the use of orthodontic miniscrews: A systematic review. Korean J Orthod. 2021; 51(3):199–216.
83. Kuroda S, Yamada K, Deguchi T, Hashimoto T, Kyung HM, Yamamoto TT. Root proximity is a major factor for screw failure in orthodontic anchorage. Am J Orthod Dentofacial Orthop. 2007 Apr; 131(4 Suppl).
84. Liou EJW, Pai BCJ, Lin JCY. Do miniscrews remain stationary under orthodontic forces? American Journal of Orthodontics and Dentofacial Orthopedics. 2004 Jul; 126(1):42–7.
85. Fabbroni G, Aabed S, Mizen K, Starr DG. Transalveolar screws and the incidence of dental damage: a prospective study. Int J Oral Maxillofac Surg. 2004 Jul; 33(5):442–6.
86. Renjen R, Maganzini AL, Rohrer MD, Prasad HS, Kraut RA. Root and pulp response after intentional injury from miniscrew placement. Am J Orthod Dentofacial Orthop. 2009 Nov; 136(5):708–14.
87. Hwang YC, Hwang HS. Surgical repair of root perforation caused by an orthodontic miniscrew implant. Am J Orthod Dentofacial Orthop. 2011 Mar 3; 139(3):407–11.
88. Tronstad L. Root resorption--etiology, terminology and clinical manifestations. Endod Dent Traumatol. 1988; 4(6):241–52.
89. BJORN LUDWIG, BETTINA GLASL, S. JAY BOWMAN, BENEDICT WILMES, GERO S.M. KINZINGER, JORG A. LISSON. Anatomical guidelines for miniscrew insertion: Palatal sites. J Clin Orthod. 2011 Aug; 45(8):433–41.
90. Smith A, Hosein YK, Dunning CE, Tassi A. Fracture resistance of commonly used self-drilling orthodontic mini-implants. Angle Orthod. 2015 Jan 1; 85(1):26–32.
91. Gurdan Z, Szalma J. Evaluation of the success and complication rates of self-drilling orthodontic mini-implants. Niger J Clin Pract. 2018 May 1; 21(5):546–52.
92. Chen Y, Kyung HM, Gao L, Yu WJ, Bae EJ, Kim SM. Mechanical properties of self-drilling orthodontic micro-implants with different diameters. Angle Orthod. 2010 Sep; 80(5):821–7.

93. Wilmes B, Rademacher C, Olthoff G, Drescher D. Parameters affecting primary stability of orthodontic mini-implants. J Orofac Orthop. 2006 May; 67(3):162–74.
94. Jia X, Chen X, Huang X. Influence of orthodontic mini-implant penetration of the maxillary sinus in the infrazygomatic crest region. Am J Orthod Dentofacial Orthop. 2018 May 1; 153(5):656–61.
95. Kravitz ND, Kusnoto B. Risks and complications of orthodontic miniscrews. Am J Orthod Dentofacial Orthop. 2007 Apr; 131
96. Li N, Sun W, Li Q, Dong W, Martin D, Guo J. Skeletal effects of monocortical and bicortical mini-implant anchorage on maxillary expansion using cone-beam computed tomography in young adults. Am J Orthod Dentofacial Orthop. 2020 May 1; 157(5):651–61
97. Bollen AM, Cunha-Cruz J, Bakko DW, Huang GJ, Hujoel PP. The effects of orthodontic therapy on periodontal health: a systematic review of controlled evidence. Journal of the American Dental Association. 2008; 139(4):413–22.
98. Papageorgiou SN, Papadelli AA, Eliades T. Effect of orthodontic treatment on periodontal clinical attachment: a systematic review and meta-analysis. Eur J Orthod. 2018 Apr 1; 40(2):176–84.
99. Van Gastel J, Quirynen M, Teughels W, Coucke W, Carels C. Influence of bracket design on microbial and periodontal parameters in vivo. J Clin Periodontol. 2007 May; 34(5):423–31.
100. Van Gastel J, Quirynen M, Teughels W, Coucke W, Carels C. Longitudinal changes in microbiology and clinical periodontal variables after placement of fixed orthodontic appliances. J Periodontol. 2008 Nov; 79(11):2078–86.
101. Evangelista K, Vasconcelos KDF, Bumann A, Hirsch E, Nitka M, Silva MAG. Dehiscence and fenestration in patients with Class I and Class II Division 1 malocclusion assessed with cone-beam computed tomography. Am J Orthod Dentofacial Orthop. 2010; 138(2):133.e1-133.e7.
102. Sheng Y, Guo HM, Bai YX, Li S. Dehiscence and fenestration in anterior teeth: Comparison before and after orthodontic treatment. Journal of Orofacial Orthopedics. 2020 Jan 1; 81(1):1–9.
103. Lund H, Gröndahl K, Gröndahl HG. Cone beam computed tomography evaluations of marginal alveolar bone before and after orthodontic treatment combined with premolar extractions. Eur J Oral Sci. 2012 Jun 1; 120(3):201–11.
104. Renkema AM, Fudalej PS, Renkema AAP, Abbas F, Bronkhorst E, Katsaros C. Gingival labial recessions in orthodontically treated and untreated individuals: a case – control study. J Clin Periodontol. 2013 Jun 1; 40(6):631–7.
105. Manuelli M, Marcolina M, Nardi N, Bertossi D, de Santis D, Ricciardi G, et al. Oral mucosal complications in orthodontic treatment. Minerva Stomatol. 2019 Feb 1; 68(2):84–8.
106. Kim H, Kim JS, Kim CS, Becker-Weimann SY, Cha JY, Choi SH. Skin irritation in children undergoing orthodontic facemask therapy. Sci Rep. 2023 Feb 7; 13(1):1–9.
107. Inger Egermark, Gunnar E. Carlsson, Tomas Magnusson. A Inger Egermark, Gunnar E. Carlsson, Tomas Magnusson. A prospective long-term study of signs and symptoms of temporomandibular disorders in patients who received orthodontic treatment in childhood. Angle Orthod. 2005 Aug; 75(4):645–50.

108. Fernández-González FJ, Cañigral A, López-Caballo JL, Brizuela A, Moreno-Hay I, del Río-Highsmith J, et al. Influence of orthodontic treatment on temporomandibular disorders. A systematic review. J Clin Exp Dent. 2015; 7(2):e320.
109. Simonsen AB, Deleuran M, Johansen JD, Sommerlund M. Contact allergy and allergic contact dermatitis in children - a review of current data. Contact Dermatitis. 2011 Nov; 65(5):254–65.
110. Krob HA, Fleischer AB, D'Agostino R, Haverstock CL, Feldman S. Prevalence and relevance of contact dermatitis allergens: a meta-analysis of 15 years of published T.R.U.E. test data. J Am Acad Dermatol. 2004 Sep; 51(3):349–53.
111. VAN HOOGSTRATEN IMW, ANDERSEN KE, VON BLOMBERG BME, BODEN D, BRUYNZEEL DP, BURROWS D, et al. Reduced frequency of nickel allergy upon oral nickel contact at an early age. Clin Exp Immunol. 1991; 85(3):441–5.
112. Novak N, Gros E, Bieber T, Allam JP. Human skin and oral mucosal dendritic cells as "good guys" and "bad guys" in allergic immune responses. Clin Exp Immunol. 2010 Jul; 161(1):28–33
113. Gölz L, Papageorgiou SN, Jäger A. Nickel hypersensitivity and orthodontic treatment: a systematic review and meta-analysis. Contact Dermatitis. 2015 Jul 1; 73(1):1–14.
114. Kolokitha OE, Kaklamanos EG, Papadopoulos MA. Prevalence of nickel hypersensitivity in orthodontic patients: a meta-analysis. Am J Orthod Dentofacial Orthop. 2008; 134(6):722.e1-722.e12.
115. Simon J. Littlewood, Laura Mitchell. An Introduction to Orthodontics - Fifth edition. In: An Introduction to Orthodontics - Fifth edition. 5th ed. 2019. p. 52–3.
116. Rischen RJ, Breuning KH, Bronkhorst EM, Kuijpers-Jagtman AM. Records needed for orthodontic diagnosis and treatment planning: a systematic review. PLoS One. 2013 Nov 12; 8(11).
117. Meriç P, Kılınç DD. Anamnesis and examination forms used in orthodontic clinics: A pilot study. American Journal of Orthodontics and Dentofacial Orthopedics. 2022 Oct 1;162(4):e169–75.
118. Benjamin EJ, Virani SS, Callaway CW, Chamberlain AM, Chang AR, Cheng S, et al. Heart Disease and Stroke Statistics-2018 Update: A Report From the American Heart Association. Circulation. 2018 Mar 1; 137(12):E67–492.
119. Bensch L, Braem M, Willems G. Orthodontic considerations in the diabetic patient. Semin Orthod. 2004 Dec 1;10(4):252–8.
120. Shah R, Collins JM, Hodge TM, Laing ER. A national study of cross infection control: "are we clean enough?" Br Dent J. 2009 Sep 26; 207(6):267–74.
121. Smith DA, Nehring SM. Bacteremia. Pediatric Emergency Medicine. 2022 Jul 31; 530–4.
122. Senkutvan RS, Jacob S, Krishnan CS, Subbiah S. Clinical Management of Medical Disorders in Orthodontics. International Journal of Dental Sciences and Research. 2014; 2(2):36–41.
123. Hobson RS, Clark JD. Infective Endocarditis Associated with Orthodontic Treatment: A Case Report. Br J Orthod. 2016; 20(3):241–4.
124. Ziolkowska L, Olczak-Kowalczyk D, Kawalec W, Turska-Kmiec A. Fixed orthodontic appliance and infective endocarditis. Pediatric Infectious Disease Journal. 2010 Dec; 29(12):1155–6.
125. Dajani AS. Bacterial endocarditis after minor orthodontic procedures. J Pediatr. 1991 Aug 1; 119(2):339–40.

126. Biancaniello TM, Romero JR. Bacterial endocarditis after adjustment of orthodontic appliances. J Pediatr. 1991 Feb 1;118(2):248–9.
127. Pallasch TJ, Slots J. Antibiotic prophylaxis and the medically compromised patient. Periodontol 2000. 1996 Feb 1; 10(1):107–38.
128. Nejat Erverdi, Ahu Acar, Bükem İşgüden, Tanju Kadir. Investigation of Bacteremia after Orthodontic Banding and Debanding Following Chlorhexidine Mouth Wash Application. Angle Orthod. 2001 Jun; 71(3):190–4.
129. Vandersluis YR, Suri S. Infective endocarditis and orthodontic implications in children: A review of the literature. Am J Orthod Dentofacial Orthop. 2020 Jan 1; 157(1):19–28.
130. Krishnan V. Orthodontic pain: from causes to management--a review. Eur J Orthod. 2007; 29(2):170–9.
131. Krishnan V, Davidovitch Z. Cellular, molecular, and tissue-level reactions to orthodontic force. Am J Orthod Dentofacial Orthop. 2006; 129(4):469.e1-469.e32.
132. Inauen DS, Papadopoulou AK, Eliades T, Papageorgiou SN. Pain profile during orthodontic levelling and alignment with fixed appliances reported in randomized trials: a systematic review with meta-analyses. Clin Oral Investig. 2023
133. Stewart FN, Kerr WJS, Taylor PJS. Appliance wear: the patient's point of view. Eur J Orthod. 1997; 19(4):377–82.
134. Marques LS, Paiva SM, Vieira-Andrade RG, Pereira LJ, Ramos-Jorge ML. Discomfort associated with fixed orthodontic appliances: determinant factors and influence on quality of life. Dental Press J Orthod. 2014 May 1; 19(3):102–7.
135. Feldmanna I. Satisfaction with orthodontic treatment outcome. Angle Orthod. 2014; 84(4):581–7.
136. Campos LA, Santos-Pinto A, Marôco J, Campos JADB. Pain perception in orthodontic patients: A model considering psychosocial and behavioural aspects. Orthod Craniofac Res. 2019 Aug 1; 22(3):213–21.
137. Sandhu SS, Leckie G. Orthodontic pain trajectories in adolescents: Between-subject and within-subject variability in pain perception. Am J Orthod Dentofacial Orthop. 2016 Apr 1; 149(4):491-500.e4.
138. Cioffi I, Michelotti A, Perrotta S, Chiodini P, Ohrbach R. Effect of somatosensory amplification and trait anxiety on experimentally induced orthodontic pain. Eur J Oral Sci. 2016 Apr 1; 124(2):127–34.
139. Sandhu SS, Sandhu J. Effect of physical activity level on orthodontic pain perception and analgesic consumption in adolescents. Am J Orthod Dentofacial Orthop. 2015 Oct 1; 148(4):618–27.
140. Topolski F, Moro A, Correr GM, Schimim SC. Optimal management of orthodontic pain. J Pain Res. 2018 Mar 16; 11:589–98.
141. Sudhakar V, Vinodhini TS, Mathan Mohan A, Srinivasan B, Rajkumar BK. The efficacy of different pre- and post-operative analgesics in the management of pain after orthodontic separator placement: A randomized clinical trial. J Pharm Bioallied Sci. 2014; 6(Suppl 1).
142. Patel S, McGorray SP, Yezierski R, Fillingim R, Logan H, Wheeler TT. Effects of analgesics on orthodontic pain. Am J Orthod Dentofacial Orthop. 2011 Jan; 139(1).
143. Polat O, Karaman AI. Pain control during fixed orthodontic appliance therapy. Angle Orthod. 2005 Mar; 75(2):214–9.

144. Ghadirian H, Nik TH, Shahsavari N, Ghadirian H, Ostad SN. Acetaminophen Versus Liquefied Ibuprofen for Control of Pain During Separation in Orthodontic Patients: A Randomized Triple Blinded Clinical Trial. Acta Med Iran. 2016 Jul 9; 54(7):418–21
145. Bird SE, Williams K, Kula K. Preoperative acetaminophen vs ibuprofen for control of pain after orthodontic separator placement. Am J Orthod Dentofacial Orthop. 2007 Oct; 132(4):504–10.
146. Salmassian R, Oesterle LJ, Shellhart WC, Newman SM. Comparison of the efficacy of ibuprofen and acetaminophen in controlling pain after orthodontic tooth movement. Am J Orthod Dentofacial Orthop. 2009 Apr; 135(4):516–21.
147. Tunçer Z, Polat-Ozsoy O, Demirbilek M, Bostanoglu E. Effects of various analgesics on the level of prostaglandin E2 during orthodontic tooth movement. Eur J Orthod. 2014; 36(3):268–74.
148. Li FJ, Zhang JY, Zeng XT, Guo Y. Low-level laser therapy for orthodontic pain: a systematic review. Lasers Med Sci. 2015 Aug 8; 30(6):1789–803.
149. Pringle AM, Petrie A, Cunningham SJ, McKnight M. Prospective randomized clinical trial to compare pain levels associated with 2 orthodontic fixed bracket systems. Am J Orthod Dentofacial Orthop. 2009 Aug; 136(2):160–7.
150. Pithon MM, Santos Fonseca Figueiredo D, Oliveira DD, Coqueiro R da S. What is the best method for debonding metallic brackets from the patient's perspective? Prog Orthod. 2015 Dec 1; 16(1).
151. Lee-Knight CT, Wylie SG, Major PW, Glover KE, Grace M. Mechanical and electrothermal debonding: effect on ceramic veneers and dental pulp. Am J Orthod Dentofacial Orthop. 1997; 112(3):263–70.
152. Normando TS, Calçada FS, Ursi W, Normando D. Patients' report of discomfort and pain during debonding of orthodontic brackets: a comparative study of two methods. World J Orthod. 2010;
153. Prasad Gupta S, Rauniyar S, Prasad P, Man P, Pradhan S. A randomized controlled trial to evaluate the effectiveness of different methods on pain management during orthodontic debonding. Prog Orthod. 2022; 23:7.
154. Cardoso PC, Espinosa DG, Mecenas P, Flores-Mir C, Normando D. Pain level between clear aligners and fixed appliances: a systematic review. Prog Orthod. 2020 Dec 1; 21(1).
155. Milton TM, Hearing SD, Ireland AJ. Ingested foreign bodies associated with orthodontic treatment: report of three cases and review of ingestion/aspiration incident management. Br Dent J. 2001; 190(11):592–6.
156. Tiwana KK, Morton T, Tiwana PS. Aspiration and ingestion in dental practice: a 10-year institutional review. J Am Dent Assoc. 2004; 135(9):1287–91.
157. Qabool H, Sukhia RH, Fida M. Assessment of cooperation and compliance in adult patients at three stages of orthodontic treatment at a tertiary care hospital: A cross-sectional study. Int Orthod. 2020 Dec 1;18(4):794–800.

Bölüm 5

A'DAN Z'YE DENTAL İŞLEMLERDE DİJİTAL DENTAL FOTOĞRAFÇILIK

Mehmet Esad GÜVEN[1]

1- DDF NEDEN TEDAVİMİZİN BİR PARÇASI OLMALI?

DDF Eskiden çok daha zahmetli ve zaman alan bir prosedürken değişen şartlar ve ilerleyen teknoloji sayesinde dijital fotoğraf çekip saklamak tedavilerde daha çok uygulanan bir yöntem haline gelmiştir. Geçmişte DDF daha çok ortodonti alanında yaygındı. Ancak özellikle estetik dental tedaviler için de son derece gereklidir. Bunun anlaşılması ile diş hekimlerinin DDF'a ilgisi artmış ve daha çok merak edilir hale gelmiştir.

Diğer yandan herhangi bir görüntü çekmeden önce fotoğraf için yazılı onay almak ve hasta gizliliğini korumak için gerekli adımları atmak da gözden kaçırılmamalıdır.

Ancak halen birçok diş hekimi; DDF çekimi ve ekipmanları ile ilgili bilgi eksikliği, iş akşındaki eksiklikler ve maliyetten dolayı DDF klinik pratiği içerisine almaya isteksiz durmaktadır.

Başlamadan önce; Neden DDF diş hekiminin klinik pratiğinin ayrılmaz bir parçası olmalı? Yaraları nelerdir?

1. Teşhis ve tedavi planlaması: özellikle estetik rehabilitasyonları içeren tüm ağız bir tedavi planması yapılıyor ise fotoğraflar bir çalışma modeli veya radyografik kayıt gibi olmazsa olmaz bir kayıttır.
2. Gelişmiş hasta eğitimi: günümüzde artan sosyal medya kullanımı ve kişiye özel reklamların artması ile tedavi araştırması yapan hastalar daha derin sorular ile karşımıza gelmektedir. DDF ile elde edilen detaylı görseller, hastanın durumunu ve tedavi önerisini/planını aktarmakta diğer yöntemlerden daha hızlı ve üstünüdür
3. Yasal Kayıt: Her klinisyen için hasta ile anlaşmazlık korkulu rüyadır. İyi dökümante edilmiş tedavi öncesi ve tedavi aşama fotoğrafları komplikasyon ve

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adapte olmak da daha kolay olacağı için eğer bu konuya hakim olursak teknoloji ilerledikçe dental fotoğraf çekimlerinin de kalitesi bundan payını alacaktır. Bu nedenle, başlangıçtaki kötü sonuçlar şevkimizi, hevesimizi kırmamalıdır.

Dental fotoğrafçılık, artık tedavi süreçlerinin takibi ve verileri depolayıp uzun vadede arşiv edinerek mesleği daha profesyonel yapmaya yardımcı olması açısından diş hekimlerine büyük bir artı kazandıracak noktaya gelmiştir. Bu noktada en iyisini yapabilmek için en rahat, kullanışlı, yeterli, kaliteli bir kamera seçip doğru ışıkta doğru açıyla ve doğru ekipmanlarla titiz bir şekilde çalışılmalı, bu noktada pratik hale gelecek çözümler üretip hasta ve hekimin yorulmayacağı, klinik rutinin aksamayacağı şekilde öngörü ve sonuçları güzel değerlendirebilecek fotoğraflar elde edilmelidir.

4- KAYNAKÇA

Ahmad, I. (2009). Digital dental photography. Part 4: choosing a camera. *Br Dent J, 206*(11), 575-581. doi:10.1038/sj.bdj.2009.476Dentistry, A. A. o. C. (2013). A GUİDE TO ACCREDITATION PHOTOGRAPHY.

Douglas A. TERRY, W. G. ESTHETIC AND RESTORATIVE DENTİSTRY.

Bölüm 6

SABİT ORTODONTİK TEDAVİLERDE ANKRAJ KONTROLÜ

Güler Nur İBİŞOĞLU[1]
Özge USLU AKÇAM[2]

GİRİŞ

Ortodontik diş hareketi, kontrollü mekanik kuvvetin dişlere ve periyodonsiyuma uygulanması sonucu ortaya çıkması ile karakterizedir. Ortodontik apareylerce uygulanan mekanik kuvvetler biyolojik aktiviteyi tetikleyerek diş hareketine neden olur. Mekanik kuvvetlere cevap, kemik remodelingi ve dişlerin repozisyonudur. Bu açıdan ortodontik tedavi, bir uyaran kuvvet sistemi ve kuvvete cevap modeli olarak değerlendirilebilir. Ortodonti pratiğinde, ankraj planlaması, tedavi planlaması içerisinde önemli bir yer tutmaktadır. Ortodontistler ankraj planlamasının öneminden dolayı, ankraj korunması adına; ağız içi ve/veya ağız dışı destek apareylerin kullanılması, bükümlerinin yapılması, ankraj kaybını azaltacak şekilde mekaniklerin hazırlanması, dişlerin tek tek hareket ettirilmesi gibi birçok yöntem denemişlerdir.

Ankraj kontrolü, istenilen tedavi etkilerini/cevabını sağlayan uygun kuvvet sistemlerini oluşturma yetisidir. Bunun için ortodontistler ankrajı korumak için çeşitli teknikler geliştirmişlerdir. Angle, Case, Tweed, Begg ve birçok klinisyen bu şekilde ortodontik mekanoterapinin gelişmesine katkıda bulunmuşlardır (1).

1. ANKRAJIN TANIMI

Literatürde ankraj için farklı tanımlamalar yapılmaktadır. 1923 yılında "ortodontik kuvvete karşı reaksiyon" tanımının, ileri yıllarda "istenmeyen diş hareketine karşı direnç" veya "diş hareketine karşı ankraj alınan ünitelerin istenilen miktarda hareketi" şeklinde gelişim gösterdiği görülmektedir (2). Ankraj, ortodontistin

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mekaniklerinin dikkatli uygulanması tedavinin süresi, tedavinin sonucu ve tedavi sonuçlarının stabilitesi için önemlidir.

Güncel teknikler değerlendirilmeli, ihtiyaç duyulan dişsel ve iskeletsel ilişki için gerekli önlemler dikkatle alınmalıdır.

KAYNAKÇA

1. Kuhlberg AJ, Priebe DN. Space closure and anchorage control. *Seminars in Orthodontics* 2001; 7: 42-49.
2. Roberts-Harry D, Sandy J. Orthodontics. Part 9: anchorage control and distal movement. *British Dental Journal* 2004 Mar 13;196(5):255-263. doi: 10.1038/sj.bdj.4811031. PMID: 15017408.
3. Graber TM. Orthodontics principles and practice. 3rd edn. Mosby: W.B. Saunders Company. 1972.
4. Gardiner JH, Leighton BC, Luffingham JK, Valialhan A. Orthodontics for dental students. 4th edn. Delhi: Oxford: Oxford university press. 1998.
5. Lewis BRK. Anchorage planning. In Littlewood SJ, Mitchell L (edn). Introduction to orthodontics. 5th edn. Oxford: Oxford university press. 2019.
6. Angle EH (1900) Treatment of malocclusion of the teeth and fractures of the Maxillae, Angle's system. 6th edn The S.S. White Dental Manufacturing Company, Philadelphia, p 109–116
7. Moyers EM. Force systems and tissue responses to forces in orthodontics and facial orthopedics (Chapter 13) In Moyers EM 4th ed. Hand Book of Orthodontics Year Book Medikal Publishers 1988: 309-311.
8. Moyers RE. Handbook of orthodontics. 4th ed. Chicago: Year book medical publishers. 1988.
9. Nanda R, Kuhlberg A. Biomechanical basis of extraction space closure (Chapter 9) In Nanda Red. Biomechanics in Clinical Orthodontics WB Saunders; 1996. p. 156-188. 4. Marcotte M.R. Spring Design (Chapter2) In Marcote M.Red. Biomechanics in Orthodontics BC Decker (Mosby) 1990: 39-43.
10. Begg Orthodontic Theory and Technique 1965 by W. B. Saunders Company. Press of W. B. Saunders Company. Library of Congress catalog card number 61-23786.
11. Sahafian AA, Heravi F, Oshagh M, Adab L. A comparative study of treatment outcomes between begg and edgewise orthodontic systems in class I cases. *Dental Research Journal* (Isfahan). 2014 Sep;11(5):574-8. PMID: 25426149; PMCID: PMC4241611.
12. Baker RW, Guay AH, Peterson HW Jr. Current concepts of anchorage management. *Angle Orthodontics* 1972; 42: 129-138.
13. Ricketts RM. Mechanics sequence for extraction cases (Part9) In Ricketts RM ed. Bioprogressive Therapy.RMO; *Journal of Clinical Orthodontics* 1979: 147-169.
14. Urias D, Mustafa FIA. Anchorage control in bioprogressive straightwire treatment. *Angle Orthodontics* 2005; 75: 987-92. Orthod 1972; 42: 129-138.
15. Gianelly AA. Extraction Treatment (Chapter 4) In Gianelly AA ed. Bidimensional technique theory and practice. GAC International 2000: 148-153.
16. Bishara S. Treatment and treatment considerations (Section IV) In Bishara SE ed. Textbook of Orthodontics W.B.Saunders Company 2001: 354-359.

17. Burstone CJ. The segmented arch approach to space closure *American Journal of Orthodontics and Dentofacial Orthopedics* 1982; 82: 361-378.
18. Viecilli RF. Self-corrective T-loop design for differential space closure. Am J Orthod Dentofacial Orthop 2006; 129: 48-53.
19. Smith, R., and Storey, E.: The Importance of Force in Orthodontics,Austral. J. Dent. 291-304. 1952.58. Storey, E., and Smith, R.: Force in Orthodontics and its Relation to Tooth Movement, *Australian Dental Journal*. 56: 11-18,1952.
20. Begg, P.R.: Differential force an orthodontic treatment, *American Journal of Orthodontics and Dentofacial Orthopedics* 1956;42: 481-510.
21. Tosun Y. Sabit Ortodontik Apareylerin Biyomekanik Prensipleri, Ege Üniversitesi Basımevi, İzmir, 1999.
22. Clocheret K, Willems G, Carels C, Celis JP. Dynamic frictional behaviour of orthodontic archwires and brackets. *European Journal Orthodontics* 2004;26:163-170.
23. Jones SP, Tan CC, Davies EH. The effects of reconditioning on the slot dimensions and static frictional resistance of stainless steel brackets. *European Journal Orthodontics* 2002;24:183-190.
24. Omana HM, Moore RN, Bagby MD. Frictional properties of metal and ceramic brackets. *Journal of Clinical Orthodontics* 1992;26:425-432.
25. Clocheret K, Willems G, Carels C, Celis JP. Dynamic frictional behaviour of orthodontic archwires and brackets. *European Journal Orthodontics* 2004;26:163-170.
26. Chimenti C, Franchi L, Giuseppe MG, Lucci M. Friction of orthodontic elastomeric ligatures with different dimensions. *American Journal of Orthodontics and Dentofacial Orthopedics* 75:421-425, 2005.
27. Sadowsky P, Rossouw PE. Friction introduction. Seminars Orthodontics 2003:9,217 Rossouw PE. Friction: an overwiev. *Seminars Orthodontics* 2003,9:218-222.
28. Lotzof LP,Fine HA,Cisneros GJ.Canine retraction: A comparison of two preadjusted bracket systems. *American Journal of Orthodontics and Dentofacial Orthopedics* 1996; 110: 191-196.
29. Angle EH The latest and best in orthodontic mechanism. *Dental Cosmos* 1929 70:260–268.
30. Andrews LF. The straight-wire appliance, origin,controversy, commentary. *Journal of clinical orthodontics* 1976;10(2):99-114
31. Mclaughlin RP, Bennet JC, Trevisi HJ. A brief history and overview of treatment mechanics (Chapter 1) In Mclaughlin RP, Bennet JC, Trevisi HJ ed. Systemized orthodontic treatment mechanics. Mosby 2001. p. 3-17.
32. Comparison of anchorage loss following initial leveling and aligning using ROTH and MBT Prescription- A clinical prospective study *Journal of International Oral Health* 2014;6(2):16-21.
33. Rinchuse DJ, Miles PG. Self-ligating brackets: present and future. *American Journal of Orthodontics and Dentofacial Orthopedics* 2007;132(2):216-222.
34. Pizzoni L, Ravnholt G, Melsen B. Frictional forces related to self-ligating brackets. *European Journal Orthodontics* 1998;20(3):283-291.
35. Sims AP, Waters NE, Birnie DJ, Pethybridge RJ. A comparison of the forces required to produce tooth movement in vitro using two self-ligating brackets and a pre-adjusted bracket employing two types of ligation. *European Journal Orthodontics* 993 Oct;15(5):377-85. doi: 10.1093/ejo/15.5.377. PMID: 8223972.

36. Thomas S, Sherriff M, Birnie D. A comparative in vitro study of the frictional characteristics of two types of self-ligating brackets and two types of preadjusted edgewise brackets tied with elastomeric ligatures. *European Journal Orthodontics* 1998;20(5):589-96.
37. Fleming PS, DiBiase AT, Lee RT. Randomized clinical trial of orthodontic treatment efficiency with self-ligating and conventional fixed orthodontic appliances. *American Journal of Orthodontics and Dentofacial Orthopedics* 2010;137:738–742.
38. Canine retraction and anchorage loss: Self-ligating versus conventional brackets in a randomized split-mouth study *Angle Orthodontist.* 2014 Sep; 84(5): 846–852.
39. Andrews LF. The six keys to normal occlusion, *American Journal of Orthodontics and Dentofacial Orthopedics* 1972;62:296-309.
40. Erikson, B.E.; Kaplan, H.; and Aisenberg, M.S.: A histological interpretation of repair phenomena following the removal of first premolars with retraction of the anterior segment, *American Journal of Orthodontics and Oral Surgery* 1945;31:1-20.
41. Irvine, R.; Power S.; and McDonald F.: The effectiveness of laceback ligatures: A randomized controlled clinical trial, Journal of Orthodontics. 2004;31:303-311.
42. Contemporary Orthodontics Sixth Edition William R. Proffit, DDS, PhD 265-266.
43. Orthodontics. Part 9: Anchorage control and distal movementD. Roberts-Harry1 and J. Sandy
44. Ülgen, M.: Diş Kavislerinin Diş Eksikliklerine Bağlı Boşluktannın Ortodontik Olarak Kapatılabileceği ve Kapatılmaması Gerektiği Vakalar. *İ.Ü. Diş Hek. Fakültesi Dergisi* 1978;12: 17-26.
45. Nanda RS, Tosun Y. Anchorage control. Biomechanics in Orthodontics: Principles and Practice (Bywaters LC, ed.) 1st edition. Hanover Park, Quintessence Publishing. 83-86, 2010
46. Effect of the transpalatal arch during extraction treatment Heather L Zablocki 1, James A McNamara Jr, Lorenzo Franchi, Tiziano Baccetti 2008 Jun;133(6):852-860.
47. Proffit WR, Fields HW, Sarver DM. The second stage of comprehensive treatment: correction of molar relationship and space closure. Contemporary Orthodontics (Dolan J, Nebel J, ed.). 4th edition. St. Louis, Mosby Elsevier. 585- 600
48. Glatzmaier J, Wehrbein H, Peter D. Biodegradable implants for orthodontic anchorage. A preliminary biomechanical study. *European Journal Orthodontics* 1996;18(5):465-469.
49. Melsen B, Verna C. Miniscrew implants: the Aarhus anchorage system. Sem Orthod. 2005;11:24-31. 73. Gainsforth BL, Higley L. A study of orthodontic anchorage possibilities in basal bone. *American Journal of Orthodontics and Oral Surgery* 1945;31(8):406-417.
50. Carano A, Velo S, Leone P, Siciliani G. Clinical applications of the miniscrew anchorage system. *Journal of clinical orthodontics* 2005;39(1):9-24.
51. Thiruvenkatachari B. Pavithranand A. Rajasigamani K, Kyung HM. Comparison and measurement of the amount of anchorage loss of the molars with and without the use of implant anchorage during canine retraction. *American Journal of Orthodontics and Dentofacial Orthopedics* 2006;129:551-554.
52. Park HS, Kwon TG, Kwon OW. Treatment of open bite with microscrew implant anchorage *American Journal of Orthodontics and Dentofacial Orthopedics* 2004; 126:627-636.

53. Jeon YJ, Kim YH, Son WS, Hans MG. Correction of a canted occlusal plane with miniscrews in a patient with facial asymmetry. *American Journal of Orthodontics and Dentofacial Orthopedics* 2006;130(2):244-52.
54. Sengupta J, Sharma SK, Sahu D. PG Canine Retraction Spring. *Medical Journal Armed Forces India* 2003 Oct;59(4):337-8. doi: 10.1016/S0377-1237(03)80149-1. Epub 2011 Jul 21. PMID: 27407557; PMCID: PMC4923545.
55. Greenfield RL. The greenfield lingual distalizer. *J clinical orthodontics* 2005; Sep: 548-56.
56. Bacetti T. A new appliance for molar distalization. Reprinted from Ortho News 2001; 1:2-6.
57. Kayalıoğlu M. Mushroom ve compaund retraction arklarının dentofasiyal yapılar üzerine etkilerinin karşılaştırılması, Doktora Tezi, Ç.Ü. 2006.

Bölüm 7

ORTOGNATİK CERRAHİDE ÖNCE CERRAHİ YAKLAŞIMI

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1. GİRİŞ

Günümüzde diş ve çenelerindeki deformite ve şekil bozukluklarını gidermek amacıyla ortodonti kliniklerine başvuran erişkin hasta sayısı oldukça fazladır. Çene şekil bozukluklarına bağlı estetik sorunların yanı sıra çiğneme ve yutma bozuklukları, konuşma bozuklukları ve ciddi vakalarda nefes alma güçlükleri gibi bir takım fonksiyonel zorluklar da tabloya eşlik eder. Estetik ve fonksiyonel problemler, dentofasiyal deformiteleri olan kişilerin yaşam kalitelerini önemli ölçüde düşürmekle birlikte maloklüzyonun şiddetindeki artış kişinin özgüvenini de etkilemektedir.

Geleneksel ortognatik cerrahi yaklaşımında cerrahi öncesi uzun soluklu ortodontik tedavinin gerek diş ve çevre dokular gerekse de yaşam kalitesi üzerindeki olumsuz etkilerinden dolayı ortognatik cerrahi kavramları son dönemlerde yeniden gözden geçirilmiştir. Böylece önce cerrahi, diğer bir deyişler 'Surgery First' yaklaşımı literatüre tanıtılmıştır.

2. ORTOGNATİK CERRAHİDE GELENEKSEL YAKLAŞIM

Geleneksel ortognatik cerrahi yaklaşımı, çene ilişkilerinin cerrahi olarak düzeltimi öncesinde preoperatif ortodontik tedavi ile dişlerin yeniden konumlandırılması felsefesine dayanır. Bununla birlikte ilk ortognatik cerrahi ameliyatları preoperatif ortodontik tedavi uygulanmaksızın yapılmaktaydı. 1963 yılında Poulton ve ark. (1) cerrahi öncesi ortodontik tedavi yapılmaksızın ameliyata alınan mandibular prognatizm vakalarında mevcut keser ilişkisi ve overjet miktarının, mandibulayı geriye alabilecekleri miktarı sınırladığını bildirmişler ve dişlerin düzgün

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seçilir ve ortodontist ile cerrah final oklüzyonu öngörecek kadar tecrübeli ve klinik kooperasyonları yüksek ise sonuçlar da bir o kadar tatmin edici olacaktır.

6. KAYNAKÇA

1. Poulton D, Taylor R, Ware W. Cephalometric x-ray evaluation of the vertical osteotomy correction of mandibular prognathism. Journal of Oral Medicine, Oral Surgery, Oral Pathology and Oral Radiology. 1963 Jul;16:807-820. doi: 10.1016/0030-4220(63)90319-0.
2. Worms F, Isaacson R, Speidel T. Surgical orthodontic treatment planning: profile analysis and mandibular surgery. Angle Orthodontist. 1976;46(1):1-25.1976.
3. Hernandez-Alfaro F, Guijarro-Martınez R. On a definition of the appropriate timing for surgical intervention in orthognathic surgery. International Journal of Oral Maxillofacial Surgery. 2014;43(7):846-55. doi: 10.1016/j.ijom.2014.02.007.
4. Choi JW, Lee JY. Current concept of the surgery-first orthognathic approach. C. 48, Archives of Plastic Surgery. 2021;48(2):199-207. doi: 10.5999/aps.2020.01305.
5. Obwegeser HL. Orthognathic surgery and a tale of how three procedures came to be: a letter to the next generations of surgeons. Clinics in Plastic Surgery. 2007;34(3):331-55. doi: 10.1016/j.cps.2007.05.014.
6. Mahmood HT, Ahmed M, Fida M. Concepts, protocol, variations and current trends in surgery first orthognathic approach: A literature review. Dental Press Journal of Orthodontics. 2018;23(3):36.e1-36.e6. doi: 10.1590/2177-6709.23.3.36.e1-6.onl.
7. Behrman SJ, Behrman DA. Oral Surgeons' Considerations in Surgical Orthodontic Treatment. Dental Clinics of North America. 1988;32(3):481-507.
8. Brachvogel P, Berten JL,Hausamen E. Surgery before orthodontic treatment: a concept for timing the combined therapy of skeletal dysgnathias. Dtsch Zahn Mund Kieferheilkd Zentralbl. 1991;79(7):557-563.
9. Reddy NVV, Potturi A. Surgery-First Orthognathic Approach. In: Bonanthaya K, Panneerselvam E, Manuel S, Kumar VV, Rai A (eds) Oral and Maxillofacial Surgery for the Clinician. Singapore: Springer Nature; 2021. p. 1463-1475.
10. Frost HM. The biology of fracture healing. An overview for clinicians. Part II. Clinical Orthopaedics and Related Research. 1989;(248):294-309.
11. Frost HM. The biology of fracture healing. An overview for clinicians. Part I. Clinical Orthopaedics and Related Research. 1989;(248):283-93.
12. Hernández-Alfaro F, Guijarro-Martínez R, Molina-Coral A. "Surgery First" in Bimaxillary Orthognathic Surgery. Journal of Oral and Maxillofacial Surgery. 2011;69(6):e201-7. doi:10.1016/j.joms.2011.01.010.
13. Hernández-Alfaro F, Guijarro-Martínez R, Peiró-Guijarro MA. Surgery First in Orthognathic Surgery: What Have We Learned? A Comprehensive Workflow Based on 45 Consecutive Cases. Journal of Oral and Maxillofacial Surgery. 2014;72(2):376-90. doi: 10.1016/j.joms.2013.08.013.
14. Uribe FA, Farrell B. Surgery-First Approach in the Orthognathic Patient. Oral and Maxillofacial Surgery Clinics of North America. 2020; p. 89-103. doi: 10.1016/j.coms.2019.08.009
15. Choi SH, Shi KK, Cha JY. Nonsurgical miniscrew-assisted rapid maxillary expansion results in acceptable stability in young adults. Angle Orthodontist. 2016; 86(5): 713–720. doi: 10.2319/101415-689.1

16. Choi JW, Bradley JP. Surgery first orthognathic approach without presurgical orthodontic treatment: questions and answers. Journal of Craniofacial Surgery. 2017; 28(5):1330-1333. doi: 10.1097/SCS.0000000000003733.
17. Villegas C, Janakiraman N, Uribe F. Rotation of the maxillomandibular complex to enhance esthetics using a "surgery first" approach. Journal of Clinical Orthodontics. 2012;46(2):85-91
18. Wei H, Liu Z, Zang J. Surgery-first/early-orthognathic approach may yield poorer postoperative stability than conventional orthodontics-first approach: a systematic review and meta-analysis. Journal of Oral Medicine, Oral Surgery, Oral Pathology and Oral Radiology. 2018;126(2):107-116. doi: 10.1016/j.oooo.2018.02.018.
19. Aymach Z, Sugawara J, Goto S. Nonextraction "surgery first" treatment of a skeletal Class III patient with severe maxillary crowding. Journal of Clinical Orthodontics. 2013; 47(5):297-304
20. Villegas C, Uribe F, Sugawara J. Expedited Correction of Significant Dentofacial Asymmetry Using a "Surgery First" Approach. Journal of Clinical Orthodontics. 2010;97-103.
21. Ching EW, Huang CS, Chen YR. Characteristics and Corrective Outcome of Face Asymmetry by Orthognathic Surgery. Journal of Oral and Maxillofacial Surgery. 2009;67(10):2201-2209. doi: 10.1016/j.joms.2009.04.039
22. Liou EJW, Chen PH, Wang YC. Surgery-first accelerated orthognathic surgery: postoperative rapid orthodontic tooth movement. Journal of Oral Maxillofacial Surgery. 2011;69(3):781-5. Doi: 10.1016/j.joms.2010.10.035
23. Choi JY, Baek SH, Kwon YH. New paradigm in orthognathic surgery and orthodontic treatment (surgery first orthognathic approach and minimum presurgical orthodontic approach).
24. Sugawara J, Aymach Z, Nagasaka DH. "Surgery first" orthognathics to correct a skeletal class II malocclusion with an impinging bite. Journal of Clinical Orthodontics. 2010 Jul;44(7):429-438.
25. Leelasinjaroen P, Godfrey K, Manosudprasit M. Surgery first orthognathic approach for skeletal class III malocclusion corrections-a literature review. Journal of Medical Association of Thailand. 2012;s:172-180.
26. Nagasaka H, Sugawara J, Kawamura H. "Surgery first" skeletal Class III correction using the Skeletal Anchorage System. Journal of Clinical Orthodontics. 2009;43(2):97-105.
27. Kim JY, Jung HD, Kim SY. Postoperative stability for surgery-first approach using intraoral vertical ramus osteotomy: 12 month follow-up. British Journal of Oral Maxillofacial Surgery. 2014 Jul;52(6):539-544. doi: 10.1016/j.bjoms.2014.03.011.
28. Choi JW, Bradley JP. Surgery First Orthognathic Approach Without Presurgical Orthodontic Treatment: Questions and Answers. Journal of Craniofacial Surgery. 2017 Jul;28(5):1330-1333. doi: 10.1097/SCS.0000000000003733.
29. Baek SH, Ahn HW, Kwon YH, Choi JY. Surgery-first approach in skeletal class III malocclusion treated with 2-jaw surgery: evaluation of surgical movement and postoperative orthodontic treatment. Journal of Craniofacial Surgery. 2010;21(2):332-8. doi: 10.1097/SCS.0b013e3181cf5fd4.
30. Choi JW, Lee JY, Yang SJ, Koh KS. The reliability of a surgery-first orthognathic approach without presurgical orthodontic treatment for skeletal class III dentofacial

deformity. Annals of Plastic Surgery. 2015;74(3):333-341. doi: 10.1097/SAP.0b013e318295dcce.
31. Yang L, Xiao YD, Liang YJ. Does the Surgery-First Approach Produce Better Outcomes in Orthognathic Surgery? A Systematic Review and Meta-Analysis. Journal of Oral Maxillofacial Surgery. 2017;75(11):2422-2429. doi: 10.1016/j.joms.2017.06.002.
32. Wang YC, Ko EWC, Huang CS. Comparison of transverse dimensional changes in surgical skeletal Class III patients with and without presurgical orthodontics. Journal of Oral Maxillofacial Surgery. 2010;68(8):1807-1812. doi: 10.1016/j.joms.2009.09.089.
33. Liao YF, Chiu YT, Huang CS. Presurgical orthodontics versus no presurgical orthodontics: treatment outcome of surgical-orthodontic correction for skeletal class III open bite. Plastic and Reconstructive Surgery. 2010;126(6):2074-2083. doi: 10.1097/PRS.0b013e3181f52710.
34. Kim CS, Lee SC, Kyung HM. Stability of mandibular setback surgery with and without presurgical orthodontics. Journal of Oral Maxillofacial Surgery. 2014;72(4):779-787. doi: 10.1016/j.joms.2013.09.033.

Bölüm 8

ORTODONTİDE GÖMÜLÜ KANİN SÜRDÜRME YÖNTEMLERİ

Rümeysa YILDIZ[1]
Özge Uslu AKÇAM[2]

GİRİŞ

Daimi dişlerin gelişimi ve sürme mekanizması oldukça hassas bir süreçtir. Diş köklerinin 1/3'ü oluştuğunda sürme işlemi başlamaktadır. Diş köklerinin 2/3'ü oluştuğunda ise diş dental ark üzerinde görülmektedir. Eğer bir diş sürme zamanı geldiği halde ağız boşluğuna ulaşmamışsa bu dişe 'gömülü diş' adı verilmektedir (1).

Dişlerin gömülü kalma sebepleri genel ve lokal sebepler olarak ikiye ayrılmaktadır. Dişlerin gömülü kalmasına sebep olan genel nedenler arasında endokrin bozukluklar, ateşli hastalıklar, D vitamini eksikliği ve radyasyon bulunmaktadır. Dişlerin gömülü kalmasına sebep olan lokal nedenler ise diş boyutu ark boyu uzunluğu uyumsuzluğu, süt dişinin uzun süreli retansiyonu, süt dişinin erken kaybı, diş tomurcuğunun anormal konumu, alveol yarığının varlığı, ankiloz, kistik veya neoplastik oluşumlar, kökün dilesarasyonu, süpernümerer dişler ve belirgin bir nedeni olmayan idiyopatik durumlar olarak bilinmektedir (2).

Dachi ve Howell, 3.875 hastanın full mouth radyografisinde gömülü dişlerin görülme sıklığını incelemiştir. En az bir gömülü dişi olan hastaların insidansını 16,7 bulmuşlardır. En sık gömülü kalan dişleri maksiller üçüncü molar dişler, ikinci en sık gömülü kalan diş mandibular üçüncü molar dişler, üçüncü en sık gömülü kalan dişler maksiller kanin ve daha sonra mandibular premolar dişler olarak bildirmişlerdir. Maksiller üçüncü molarların gömülü kalma insidansını 21,9; mandibular üçüncü molarların gömülü kalma insidansını 17,5; maksiller kaninlerin gömülü kalma insidansını 0,92 olarak bulmuşlardır. Maksiller

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KAYNAKÇA

1. Korbendau JM, Patti A. Diş Hekimleri İçin Gömülü Dişlerin Cerrahi- Ortodontik Tedavisi Klinik Rehberi. (İlter Uzel, Çev. Ed.). İstanbul: Quintessence Yayınevi;2020 p.22-43
2. Bishara SE. Impacted maxillary canines: a review. 1992 Feb;101(2):159-71. doi: 10.1016/0889-5406(92)70008-X. PMID: 1739070.
3. Dachi, S F, Howell FV. A survey of 3,874 routine full-mouth radiographs. I. A study of retained roots and teeth. *Oral surgery, Oral Medicine, and Oral Pathology* 1961;14:916-924. doi:10.1016/0030-4220(61)90003-2
4. Ericson, S, Kurol J. Radiographic assessment of maxillary canine eruption in children with clinical signs of eruption disturbance. *European Journal of Orthodontics* 1986;8(3):133-140. doi:10.1093/ejo/8.3.133
5. Clark, D. "The management of impacted canines: free physiologic eruption." *Journal of the American Dental Association* 1971;82(4):836-840. doi:10.14219/jada. archive.1971.0153
6. Jacoby, H. "The etiology of maxillary canine impactions." 1983;84(2):125-132. doi:10.1016/0002-9416(83)90176-8
7. Johnston, W. D. *Treatment o f palatally impacted canine teeth. American Journal of Orthodontics, 1969;56(6):589–596.* doi:10.1016/0002-9416(69)90194-8
8. Korbendau JM, Patti A. Diş Hekimleri İçin Gömülü Dişlerin Cerrahi- Ortodontik Tedavisi Klinik Rehberi. (İlter Uzel, Çev. Ed.). İstanbul: Quintessence Yayınevi;2020 p. 186-187
9. Bishara SE, Kommer DD, McNeil MH et al. Management of impacted canines. *American Journal of Orthodontics* 1976;69(4):371-387. doi:10.1016/0002-941676)90207-4
10. Ravi I, Srinivasan B, Kailasam V. Radiographic predictors of maxillary canine impaction in mixed and early permanent dentition - A systematic review and meta-analysis. *International Orthodontics* 2021;19(4):548-565. doi:10.1016/j.ortho.2021.07.005
11. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. *European Journal of Orthodontics.* 1988;10(4):283-295. doi:10.1093/ejo/10.4.283
12. Counihan K, Al-Awadhi EA, Butler J. Guidelines for the assessment of the impacted maxillary canine. *Dental Update.* 2013;40(9):770-777. doi:10.12968/denu.2013.40.9.770
13. Schroeder MA, Schroeder DK, Capelli Júnior J et al. Orthodontic traction of impacted maxillary canines using segmented arch mechanics. *Dental Press Journal of Orthodontics*. 2019;24(5):79-89. Published 2019 Nov 11. doi:10.1590/2177-6709.24.5.079-089.sar
14. Korbendau JM, Patti A. Diş Hekimleri İçin Gömülü Dişlerin Cerrahi- Ortodontik Tedavisi Klinik Rehberi. (İlter Uzel, Çev. Ed.). İstanbul: Quintessence Yayınevi;2020 p.61-68
15. Kokich VG. Surgical and orthodontic management of impacted maxillary canines. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2004;126(3):278-283. doi:10.1016/j.ajodo.2004.06.009
16. Fournier A, Turcotte JY, Bernard C. Orthodontic considerations in the treatment of maxillary impacted canines. *American Journal of Orthodontics.* 1982;81(3):236-239. doi:10.1016/0002-9416(82)90056-2

17. Korbendau JM, Patti A. Diş Hekimleri İçin Gömülü Dişlerin Cerrahi- Ortodontik Tedavisi Klinik Rehberi. (İlter Uzel, Çev. Ed.). İstanbul: Quintessence Yayınevi;2020 p.111-116
18. Tepedino M, Chimenti C, Masedu F et al. Predictable method to deliver physiologic force for extrusion of palatally impacted maxillary canines. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2018;153(2):195-203. doi:10.1016/j.ajodo.2017.05.035
19. Jacoby H. The 'ballista spring" system for impacted teeth. *American Journal of Orthodontics* 1979;75(2):143-151. doi:10.1016/0002-9416(79)90183-0
20. Verma S, Singh SP, Verma RK et al. Success rate, treatment duration, and pain perception in the management of palatally impacted canines using the K9 and Ballista spring: a randomized clinical trial. *The Angle Orthodontist* 2023;93(1):33-40. doi:10.2319/042122-304.1
21. Crescini A, Clauser C, Giorgetti R et al. Tunnel traction of infraosseous impacted maxillary canines. A three-year periodontal follow-up. *American Journal of Orthodontics and Dentofacial Orthopedics* 1994;105(1):61-72. doi:10.1016/S0889-5406(94)70100-8
22. Aksu M, Taner T. Palatinalde gömülü maksiller kanin dişin tünel traksiyon yöntemiyle tedavisi. *Hacettepe Üniversitesi Diş Hekimliği Fakültesi Dergisi* 2006;30:48-58.
23. Vardimon AD, Graber TM, Drescher D et al. Rare earth magnets and impaction. *American Journal of Orthodontics and Dentofacial Orthopedics.* 1991;100(6):494-512. doi:10.1016/S0889-5406(08)80004-2
24. Bowman SJ, Carano A. The Kilroy Spring for impacted teeth. *Journal of Clinical Orthodontics.* 2003;37(12):683-688.
25. Yadav S, Chen J, Upadhyay M et al. Comparison of the force systems of 3 appliances on palatally impacted canines. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2011;139(2):206-213. doi:10.1016/j.ajodo.2009.04.027
26. Schroeder MA, Schroeder DK, Capelli Júnior J et al. Orthodontic traction of impacted maxillary canines using segmented arch mechanics. *Dental Press Journal of Orthodontics.* 2019;24(5):79-89. doi:10.1590/2177-6709.24.5.079-089.sar
27. Yadav S, Upadhyay M, Uribe F et al. Mechanics for treatment of impacted and ectopically erupted maxillary canines. *Journal of Clinical Orthodontics*. 2013;47(5):305-328.
28. Verma S, Bhupali NR, Singh SP. 3-Dimensional retraction spring for buccally impacted canines. *Journal of Indian Orthodontic Society.* 2021;55(04):424-425. doi: 10.1177/03015742211007619
29. Noroozian M, Merati M, Heravi F et al. Introducing a User-Friendly Technique for Treatment of Palatally-Impacted Canines with the Aid of Temporary Anchorage Devices. *Journal of Dentistry* 2022;23(4):511-519. doi:10.30476/DENTJODS.2022.91156.1557
30. Schubert M. The alignment of impacted and ectopic teeth using the Easy-Way-Coil (EWC) System. *Journal of Orofacial Orthopedics.* 2008;69(3):213-226. doi:10.1007/s00056-008-0722-9
31. Shastri D, Nagar A, Tandon P. Alignment of palatally impacted canine with open window technique and modified K-9 spring. *Contemporary Clinical Dentistry.* 2014;5(2):272-274. doi:10.4103/0976-237X.132362
32. Korbendau JM, Patti A. Diş Hekimleri İçin Gömülü Dişlerin Cerrahi- Ortodontik Tedavisi Klinik Rehberi. (İlter Uzel, Çev. Ed.). İstanbul: Quintessence Yayınevi;2020 p.204-208

33. Celebi F, Bicakci AA. The shoulder spring for eruption of impacted canines. *Journal of Clinical Orthodontics*. 2017;51(10):657-660.
34. Kim SH, Choo H, Hwang YS et al. Double-archwire mechanics using temporary anchorage devices to relocate ectopically impacted maxillary canines. *World Journal of Orthodontics*. 2008;9(3):255-266.
35. Sinha PK, Nanda RS. Management of impacted maxillary canines using mandibular anchorage. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1999;115(3):254-257. doi:10.1016/s0889-5406(99)70326-4
36. Kachoei M, Ghanizadeh M, Esmailzadeh M et al. A Novel Spring for Impacted Canine Traction: A New Method presentation. *Advances in Bioscience and Clinical Medicine*. 2019; 7(2):25-27
37. Sarica I, Derindag G, Kurtuldu E et al. A retrospective study: Do all impacted teeth cause pathology? *Nigerian Journal of Clinical Practice* 2019 Apr;22(4):527-533. doi: 10.4103/njcp.563_18. PMID: 30975958
38. Sajnani AK, King NM. Complications associated with the occurrence and treatment of impacted maxillary canines. *Singapore Dental Journal*. 2014;35:53-57. doi:10.1016/j.sdj.2014.07.001

Bölüm 9

ORTODONTİK TEDAVİDE VERTİKAL YÖN KONTROLÜ

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GİRİŞ

Geçtiğimiz yüzyılda ortodontik tanı ve tedavi planlaması öncelikle anteroposterior iskelet-yüz boyutuna odaklanmıştır. Günümüzde malokluzyonların mevcut sınıflandırma sistemi hala esas olarak vertikal veya horizontal boyutla ilgili herhangi bir bilgi sağlamayan Edward Angle tarafından tarif edildiği gibi kalmıştır. Vertikal yüz boyutunun öneminin vurgulanması son birkaç dekatta gerçekleşmiştir. Başarılı bir anteroposterior düzeltme için vertikal boyutun yeterli kontrolü önem taşımaktadır.

GENEL BİLGİLER

Mandibulanın Vertikal Yön Büyüme ve Gelişimi

Mandibulanın vertikal yön büyüme ve gelişimi, aşağıdaki bölgelerde meydana gelmektedir.

Kondiler Büyüme

Dişlerin sürmeleri için vertikal alveolar kemik büyümesi gereklidir. Alveol kemiğinin vertikal yönde gelişimine yer sağlamak amacıyla, kondil aynı zamanda yukarı doğru da büyümektedir. Ortalama büyüme ve gelişimde kondiler büyüme yönü; bebekte hem sagital hem de vertikal yönde arkaya ve yukarıya doğru iken, yaş ilerledikçe daha çok vertikal yönde yukarı doğru gerçekleşmektedir (1).

Processus Coronoideus ve Incisura Mandibularis'te Apozisyon

Kondil yukarı ve arkaya doğru büyürken hem processus coronoideus hem de incisura mandibularis'te meydana gelen apozisyonlarla ramus bütünüyle arkaya

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ebatlarının büyük ve bu sebeple hasta toleransının az olması, diş rotasyonlarının pekiştirmesinde diğer retainerlar kadar etkili olmaması ve temel fonksiyon kaybına neden olmasıdır (71,72).

8 haftalık izometrik kas egzersizinin oklüzal temas alanını arttırdığı ve oklüzal temas alanının dengesini geliştirdiği gösterilmiştir. Posterior oklüzyonun retansiyon döneminde geliştirilmesi için "sakız egzersizi" tasarlanmıştır. Yapılan çalışmada, 4 hafta boyunca günde 30 ila 45 dakika sakız çiğneme egzersizi sonunda, toplam oklüzal kuvvet %140'a, toplam temas alanı %125'e yükselmiş ancak oklüzal basınç başlangıç değerlerine göre (egzersiz öncesi) aynı kalmıştır. Egzersizin bitiminden bir ay sonra, artmış oklüzal kuvvet ve oklüzal temas alanı, taban çizgisinin sırasıyla %105 ve %103'üne düşmüştür. Bu sonuçlar, sakız egzersizinin oklüzal temas ve oklüzal kuvveti artırmada etkili olduğunu göstermektedir. Retansiyon döneminde kullanılabilir.

SONUÇ VE ÖNERİLER

Ortodontik tedavi için başvuran hastaların %22'sini hiperdiverjan hastalar oluşturmaktadır. Sabit tadavi mekanikleri de vertikal boyutu kötüleştirme eğilimindedir. Bu nedenle analizlerde vertikal kontrol gerekliliği mutlaka değerlendirilmelidir.

Vertikal kontrol için gerekli mekanik seçiminde yaş göz önünde bulundurulmalıdır. TAD'lar özellikle erişkin hastalarda iyi bir alternatiftir. Tedavi sırasında elastik kullanımına dikkat edilmeli, Sınıf II ve Sınıf III elastikler kullanılacaksa kısa kullanılması tercih edilmelidir.

Tüm ortodontik tedavilerde olduğu gibi stabilite için öncelik etiyolojinin ortadan kaldırılması yönünde olmalıdır. Vertikal büyüme paterni için en önemli çevresel etiyolojik faktör burun solunumunun gerçekleştirilememesidir. Hastalar burun solunumunu sağlayabilmesi için gerekli hekime yönlendirilmelidir.

Retansiyonda positioner ya da sakız egzersizi kullanılabilir.

KAYNAKÇA

1. Stöckli PW. [The reactivity of the mandibular joint cartilage to orthopedic stimulation during the phase of growth]. SSO Schweiz Monatsschr Zahnheilkd. Mayıs 1972;82(5):558-76 contd.
2. Björk A, Skieller V. Normal and abnormal growth of the mandible. A synthesis of longitudinal cephalometric implant studies over a period of 25 years. Eur J Orthod. Şubat 1983;5(1):1-46.
3. Björk A. Prediction of mandibular growth rotation. Am J Orthod. Haziran 1969;55(6):585-99.

4. Spyropoulos MN, Askarieh M. Vertical control: a multifactorial problem and its clinical implications. Am J Orthod. Temmuz 1976;70(1):70-80.
5. Proffit WR, Phillips C, Dann C. Who seeks surgical-orthodontic treatment? Int J Adult Orthodon Orthognath Surg. 1990;5(3):153-60.
6. Pearson LE. Vertical control in treatment of patients having backward-rotational growth tendencies. Angle Orthod. Nisan 1978;48(2):132-40.
7. Schudy F. Vertical Growth Versus Anteroposterior Growth As Related To Function And Treatment. Angle Orthodontist. 1963;34(2):75-93.
8. Ricketts RM. A study of changes in temporomandibular relations associated with the treatment of Class II malocclusion (Angle). Am J Orthod. Aralık 1952;38(12):918-33.
9. Schudy FF. The control of vertical overbite in clinical orthodontics. Angle Orthod. Ocak 1968;38(1):19-39.
10. Upadhyay M, Yadav S, Nanda R. Vertical-dimension control during en-masse retraction with mini-implant anchorage. Am J Orthod Dentofacial Orthop. Temmuz 2010;138(1):96-108.
11. Harvold EP, Tomer BS, Vargervik K, Chierici G. Primate experiments on oral respiration. Am J Orthod. Nisan 1981;79(4):359-72.
12. Trask GM, Shapiro GG, Shapiro PA. The effects of perennial allergic rhinitis on dental and skeletal development: a comparison of sibling pairs. Am J Orthod Dentofacial Orthop. Ekim 1987;92(4):286-93.
13. Linder-Aronson S. Adenoids. Their effect on mode of breathing and nasal airflow and their relationship to characteristics of the facial skeleton and the denition. A biometric, rhino-manometric and cephalometro-radiographic study on children with and without adenoids. Acta Otolaryngol Suppl. 1970;265:1-132.
14. Vig KW. Nasal obstruction and facial growth: the strength of evidence for clinical assumptions. Am J Orthod Dentofacial Orthop. Haziran 1998;113(6):603-11.
15. Proffit W, White R, Sarver D. Long face problems. Içinde: Contemporary treatment of dentofacial deformity. St Louis: Mosby; 2003. s. 464-506.
16. Ingervall B, Thilander B. Relation between facial morphology and activity of the masticatory muscles. J Oral Rehabil. Nisan 1974;1(2):131-47.
17. Kuhn RJ. Control of anterior vertical dimension and proper selection of extraoral anchorage. Angle Orthod. Ekim 1968;38(4):340-9.
18. Sarver D. Facial analysis and the facial esthetic problem list. Içinde: Esthetic orthodontics and orthognathic surgery. St Louis: Mosby; 1998. s. 2-55.
19. Siriwat PP, Jarabak JR. Malocclusion and facial morphology is there a relationship? An epidemiologic study. Angle Orthod. Nisan 1985;55(2):127-38.
20. Dung DJ, Smith RJ. Cephalometric and clinical diagnoses of open bite tendency. Am J Orthod Dentofacial Orthop. Aralık 1988;94(6):484-90.
21. English JD. Early treatment of skeletal open bite malocclusions. Am J Orthod Dentofacial Orthop. Haziran 2002;121(6):563-5.
22. Işcan HN, Akkaya S, Koralp E. The effects of the spring-loaded posterior bite-block on the maxillo-facial morphology. Eur J Orthod. Şubat 1992;14(1):54-60.
23. Sankey WL, Buschang PH, English J, Owen AH. Early treatment of vertical skeletal dysplasia: the hyperdivergent phenotype. Am J Orthod Dentofacial Orthop. Eylül 2000;118(3):317-27.

24. Schulz SO, McNamara JA, Baccetti T, Franchi L. Treatment effects of bonded RME and vertical-pull chincup followed by fixed appliance in patients with increased vertical dimension. Am J Orthod Dentofacial Orthop. Eylül 2005;128(3):326-36.
25. Torres F, Almeida RR, de Almeida MR, Almeida-Pedrin RR, Pedrin F, Henriques JFC. Anterior open bite treated with a palatal crib and high-pull chin cup therapy. A prospective randomized study. Eur J Orthod. Aralık 2006;28(6):610-7.
26. Kim YH, Han UK, Lim DD, Serraon ML. Stability of anterior openbite correction with multiloop edgewise archwire therapy: A cephalometric follow-up study. Am J Orthod Dentofacial Orthop. Temmuz 2000;118(1):43-54.
27. Yao CCJ, Wu CB, Wu HY, Kok SH, Chang HFF, Chen YJ. Intrusion of the overerupted upper left first and second molars by mini-implants with partial-fixed orthodontic appliances: a case report. Angle Orthod. Ağustos 2004;74(4):550-7.
28. Lee JS, Kim DH, Park YC, Kyung SH, Kim TK. The efficient use of midpalatal miniscrew implants. Angle Orthod. Ekim 2004;74(5):711-4.
29. Bailey LJ, Proffit WR, Blakey GH, Sarver DM. Surgical modification of long-face problems. Semin Orthod. Eylül 2002;8(3):173-83.
30. Kouvelis G, Dritsas K, Doulis I, Kloukos D, Gkantidis N. Effect of orthodontic treatment with 4 premolar extractions compared with nonextraction treatment on the vertical dimension of the face: A systematic review. Am J Orthod Dentofacial Orthop. Ağustos 2018;154(2):175-87.
31. Ngan P, Wilson S, Florman M, Wei SH. Treatment of Class II open bite in the mixed dentition with a removable functional appliance and headgear. Quintessence Int. Mayıs 1992;23(5):323-33.
32. Wise JB, Magness WB, Powers JM. Maxillary molar vertical control with the use of transpalatal arches. Am J Orthod Dentofacial Orthop. Ekim 1994;106(4):403-8.
33. Kupietzky A, Tal E. The transpalatal arch: an alternative to the Nance appliance for space maintenance. Pediatr Dent. 2007;29(3):235-8.
34. Kim YH. Anterior openbite and its treatment with multiloop edgewise archwire. Angle Orthod. Ekim 1987;57(4):290-321.
35. Lione R, Kiliaridis S, Noviello A, Franchi L, Antonarakis GS, Cozza P. Evaluation of masseter muscles in relation to treatment with removable bite-blocks in dolichofacial growing subjects: A prospective controlled study. Am J Orthod Dentofacial Orthop. Haziran 2017;151(6):1058-64.
36. Albogha MH, Takahashi I, Sawan MN. Early treatment of anterior open bite: Comparison of the vertical and horizontal morphological changes induced by magnetic bite-blocks and adjusted rapid molar intruders. Korean J Orthod. Ocak 2015;45(1):38-46.
37. Deberardinis M, Stretesky T, Sinha P, Nanda RS. Evaluation of the vertical holding appliance in treatment of high-angle patients. Am J Orthod Dentofacial Orthop. Haziran 2000;117(6):700-5.
38. Baccetti T, Franchi L, Schulz SO, McNamara JA. Treatment timing for an orthopedic approach to patients with increased vertical dimension. Am J Orthod Dentofacial Orthop. Ocak 2008;133(1):58-64.
39. Gkantidis N, Halazonetis DJ, Alexandropoulos E, Haralabakis NB. Treatment strategies for patients with hyperdivergent Class II Division 1 malocclusion: is vertical dimension affected? Am J Orthod Dentofacial Orthop. Eylül 2011;140(3):346-55.

40. Antonarakis GS, Kiliaridis S. Treating Class II malocclusion in children. Vertical skeletal effects of high-pull or low-pull headgear during comprehensive orthodontic treatment and retention. Orthod Craniofac Res. Mayıs 2015;18(2):86-95.
41. Hayasaki SM, Castanha Henriques JF, Janson G, de Freitas MR. Influence of extraction and nonextraction orthodontic treatment in Japanese-Brazilians with class I and class II division 1 malocclusions. Am J Orthod Dentofacial Orthop. Ocak 2005;127(1):30-6.
42. Abraham J, Bagchi P, Gupta S, Gupta H, Autar R. Combined orthodontic and surgical correction of adult skeletal class II with hyperdivergent jaws. Natl J Maxillofac Surg. Ocak 2012;3(1):65-9.
43. Arabion H, Tabrizi R, Fattahi H, Khaghaninezhad M, Bahramnia F. Spatial changes of the chin in the vertical and sagittal planes after superior repositioning of the maxilla. J Craniofac Surg. Mayıs 2015;26(3):e249-53.
44. Catherine Z, Breton P, Bouletreau P. Condylar resorption after orthognathic surgery: A systematic review. Rev Stomatol Chir Maxillofac Chir Orale. Şubat 2016;117(1):3-10.
45. Moran I, Virdee S, Sharp I, Sulh J. Postoperative Complications Following LeFort 1 Maxillary Advancement Surgery in Cleft Palate Patients: A 5-Year Retrospective Study. Cleft Palate Craniofac J. Şubat 2018;55(2):231-7.
46. Baas EM, van Gemert BPHM, Bierenbroodspot F, Milstein DMJ, de Lange J. Patient discomfort and other side effects after bilateral sagittal split osteotomy or distraction osteogenesis of the mandible: a randomized clinical trial. Int J Oral Maxillofac Surg. Eylül 2015;44(9):1119-24.
47. Moshiri S, Araújo EA, McCray JF, Thiesen G, Kim KB. Cephalometric evaluation of adult anterior open bite non-extraction treatment with Invisalign. Dental Press J Orthod. 2017;22(5):30-8.
48. Freitas BV, Abas Frazão MC, Dias L, Fernandes Dos Santos PC, Freitas HV, Bosio JA. Nonsurgical correction of a severe anterior open bite with mandibular molar intrusion using mini-implants and the multiloop edgewise archwire technique. Am J Orthod Dentofacial Orthop. Nisan 2018;153(4):577-87.
49. Cousley RRJ. Molar intrusion in the management of anterior openbite and "high angle" Class II malocclusions. J Orthod. Eylül 2014;41 Suppl 1:S39-46.
50. Boyd SB, Gonyea WJ, Finn RA, Woodard CE, Bell WH. Histochemical study of the masseter muscle in patients with vertical maxillary excess. J Oral Maxillofac Surg. Şubat 1984;42(2):75-83.
51. Cangialosi TJ. Skeletal morphologic features of anterior open bite. Am J Orthod. Ocak 1984;85(1):28-36.
52. Ingervall B, Bitsanis E. A pilot study of the effect of masticatory muscle training on facial growth in long-face children. Eur J Orthod. Şubat 1987;9(1):15-23.
53. Kalra V, Burstone CJ, Nanda R. Effects of a fixed magnetic appliance on the dentofacial complex. Am J Orthod Dentofacial Orthop. Haziran 1989;95(6):467-78.
54. Kuster R, Ingervall B. The effect of treatment of skeletal open bite with two types of bite-blocks. Eur J Orthod. Aralık 1992;14(6):489-99.
55. Dellinger EL, Dellinger EL. Active vertical corrector treatment--long-term follow-up of anterior open bite treated by the intrusion of posterior teeth. Am J Orthod Dentofacial Orthop. Ağustos 1996;110(2):145-54.

56. Woods MG, Nanda RS. Intrusion of posterior teeth with magnets. An experiment in growing baboons. Angle Orthod. Nisan 1988;58(2):136-50.
57. Kiliaridis S, Egermark I, Thilander B. Anterior open bite treatment with magnets. Eur J Orthod. Kasım 1990;12(4):447-57.
58. Chiba Y, Motoyoshi M, Namura S. Tongue pressure on loop of transpalatal arch during deglutition. Am J Orthod Dentofacial Orthop. Ocak 2003;123(1):29-34.
59. Umemori M, Sugawara J, Mitani H, Nagasaka H, Kawamura H. Skeletal anchorage system for open-bite correction. Am J Orthod Dentofacial Orthop. Şubat 1999;115(2):166-74.
60. Cetlin NM, Ten Hoeve A. Nonextraction treatment. J Clin Orthod. Haziran 1983;17(6):396-413.
61. Roth RH. Treatment mechanics for the straight wire appliance. Içinde: Graber T, Swain B, editörler. Orthodontics: Current Principles and Techniques. St Louis: Mosby; 1985. s. 665-716.
62. Staggers JA. Vertical changes following first premolar extractions. Am J Orthod Dentofacial Orthop. Ocak 1994;105(1):19-24.
63. Aras A. Vertical changes following orthodontic extraction treatment in skeletal open bite subjects. Eur J Orthod. Ağustos 2002;24(4):407-16.
64. Kim YH, Han UK, Lim DD, Serraon ML. Stability of anterior openbite correction with multiloop edgewise archwire therapy: A cephalometric follow-up study. Am J Orthod Dentofacial Orthop. Temmuz 2000;118(1):43-54.
65. Lee JS, Kim DH, Park YC, Kyung SH, Kim TK. The efficient use of midpalatal miniscrew implants. Angle Orthod. Ekim 2004;74(5):711-4.
66. Carrillo R, Rossouw PE, Franco PF, Opperman LA, Buschang PH. Intrusion of multiradicular teeth and related root resorption with mini-screw implant anchorage: a radiographic evaluation. Am J Orthod Dentofacial Orthop. Kasım 2007;132(5):647-55.
67. Erverdi N, Usumez S, Solak A. New generation open-bite treatment with zygomatic anchorage. Angle Orthod. Mayıs 2006;76(3):519-26.
68. Cozza P, Mucedero M, Baccetti T, Franchi L. Early orthodontic treatment of skeletal open-bite malocclusion: a systematic review. Angle Orthod. Eylül 2005;75(5):707-13.
69. Sugawara J, Nishimura M. Minibone plates: The skeletal anchorage system. Semin Orthod. Mart 2005;11(1):47-56.
70. Haydar B, Saatçi P. Sabit ortodontik tedavi bitiminde positioner apareyi kullanımı. Turkish J Orthod. 1993;6(1):119-22.
71. Proffit W. Retention. Içinde: Contempory orthodontics. 5. bs St Louis: Mosby; 2013. s. 606-20.
72. Graber L, Vanarsdall R, Vig K. Stability, Retention and Relapse. Içinde: Orthodontics: Current Principle and Techniques. 5. bs St. Louis: Mosby; 2012.

Bölüm 10

ORTODONTİK DİŞ HAREKETİNİN HIZLANDIRILMASI

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GİRİŞ

Ortodontik tedavi görmek isteyen hastaları en çok rahatsız eden konulardan birisi de tedavi süresinin uzunluğudur. Tedavi süresi ortalama 24-36 ay arasında değişmekte olup (1,2), süre uzadıkça çürük gelişme riskinde artış görülmesi (3,4), kök rezorbsiyonları görülmesi (5,6) ve hasta kooperasyonunun azalması (7) gibi olası komplikasyonların görülmesine yol açmaktadır. Bu nedenlerden ötürü diş hareketini hızlandırmak ve tedavi süresini kısaltmak için geleneksel uygulanan kuvvetlere ek olarak, çevre dokularda yıkımı arttıracak, hücre aktivitelerini artıracak çeşitli yöntemler uygulanmaktadır.

Dişe mekanik kuvvet uygulandığında diş ve çevre dokularda remodeling sürecinin de dahil biyolojik reaksiyonlar görülmektedir. Dişlere ortodontik kuvvet uygulaması sonucunda, periodontal ligamentte kan akımında değişiklikler oluşmakta ve periodontal aralığa çok sayıda çeşitli mediatör salınımı gerçekleşmektedir. Salınan bu mediatörler yapım-yıkımı da barındıran çeşitli hücresel ve bölgesel aktivasyonların başlamasında rol oynar. Tüm bunlar genel olarak bilinse ve söylense de ortodontik diş hareketinin net bir açıklaması halen yoktur

Günümüzde yapılan çalışmalar neticesinde, diş hareketi oluşmasında uygulanan mekanik kuvvetlerin tek etken olmadığı görülmüş (8), ortodontik diş hareketlerini daha hızlı gerçekleştirebilmek için kimyasalların kullanımına (9),elektromanyetik uyaranların kullanımına (10,11), lazer uygulamasına (12) ve cerrahi (13,14) uygulamalarının yapılmasına olan ilgi giderek artmaktadır.

Diş hareketini hızlandırmak amacıyla gerçekleştirilen uygulamalar; kimyasal, mekanik ve cerrahi yöntemler olmak üzere esasen üç ana başlıkta incelenmekte

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KAYNAKÇA

1. Fink DF, Smith RJ.The duration of orthodontic treatment. *Am J Orthod Dentofacial Orthop*.1992; 102(1):45-51.
2. Fisher MA, Wenger RM, Hans MG. Pretreatment characteristics associated with orthodontic treatment duration. *Am J Orthod Dentofacial Orthop*.2010;137(2): 178-186.
3. Geiger AM, Gorelick L, Gwinnett AJ, et al. Reducing white spot lesions in orthodontic populations with fluoride rinsing. *Am J Orthod Dentofacial Orthop*.1992;101(5):403-407.
4. Bishara SE, Ostby AW. White spot lesions: formation, prevention, and treatment. *Semin Orthod*. 2008;174-182.
5. Segal G, Schiffman P, Tuncay O.Meta analysis of the treatment-related factors of external apical root resorption. *Orthod Craniofac Res*.2004;7(2): 71-78.
6. Pandis N, Nasika M, Polychronopoulou A, et al. External apical root resorption in patients treated with conventional and self-ligating brackets. *Am J Orthod Dentofacial Orthop*.2008;134(5): 646-651.
7. Royko A, Denes Z, Razouk G.The relationship between the length of orthodontic treatment and patient compliance. *Fogorv Sz*. 1999;92(3):79-86.
8. Abbas NH, Sabet NE, Hassan IT. Evaluation of corticotomy-facilitated orthodontics and piezocision in rapid canine retraction. *Am J Orthod Dentofacial Orthop*.2016;149(4): 473-480.
9. Igarashi K, Mitani H, Adachi H, et al. Anchorage and retentive effects of a bisphosphonate (AHBuBP) on tooth movements in rats. *Am J Orthod Dentofacial Orthop*. 1994;106(3):279-289.
10. Davidovitch Z, Finkelson MD, Steigman S, et al. Electric currents, bone remodeling, and orthodontic tooth movement: II. Increase in rate of tooth movement and periodontal cyclic nucleotide levels by combined force and electric current. *Am J Orthod Dentofacial Orthop*.1980;77(1):33-47.
11. Stark TM, Sinclair PM. Effect of pulsed electromagnetic fields on orthodontic tooth movement. *Am J Orthod Dentofacial Orthop*.1987;91(2):91-104.
12. Kawasaki K, Shimizu N, 2000. Effects of low-energy laser irradiation on bone remodeling during experimental tooth movement in rats. Lasers in Surgery and Medicine: *The Official Journal of the American Society for Laser Medicine and Surgery*.2000;26(3): 282-291.
13. Liou EJ, Huang CS.Rapid canine retraction through distraction of the periodontal ligament. *Am J Orthod Dentofacial Orthop*.1998;114(4): 372-382.
14. Wilcko WM, Wilcko MT, Bouquot J, et all. Rapid orthodontics with alveolar reshaping: two case reports of decrowding. *Int J Periodontics Restorative Dent*.2001;21(1):9-20.
15. Ren Y, Maltha JC, Kuijpers-Jagtman AM. Optimum force magnitude for orthodontic tooth movement: a systematic literature review. *Angle Orthod*.2003;73(1):86-92.
16. Collins MK, Sinclair PM. The local use of vitamin D to increase the rate of orthodontic tooth movement. *Am J Orthod Dentofacial Orthop*.1988;94(4):278-284.
17. Sekhavat AR, Mousavizadeh K, Pakshir HR, et all. Effect of misoprostol, a prostaglandin E1 analog, on orthodontic tooth movement in rats. *Am J Orthod Dentofacial Orthop*.2022;122(5):542-547.
18. Bartzela T, Türp JC, Motschall E, et all. Medication effects on the rate of orthodontic tooth movement: a systematic literature review. *Am J Orthod Dentofacial Orthop*.2009;135(1):16-26.

19. Seifi M, Eslami B, Saffar AS, 2003. The effect of prostaglandin E2 and calcium gluconate on orthodontic tooth movement and root resorption in rats *Eur. J Orthod.* 2003;25(2):199-204.
20. Kale S, Kocadereli I, Atilla P, et all. Comparison of the effects of 1, 25 dihydroxycholecalciferol and prostaglandin E2 on orthodontic tooth movement. *Am J Orthod Dentofacial Orthop.*2004;125(5):607-614.
21. Seifi M, Hamedi R, Khavandegar Z. The effect of thyroid hormone, prostaglandin E2, and calcium gluconate on orthodontic tooth movement and root resorption in rats. *J. Dent.2015;* 16, 1 Suppl, 35.
22. Jee W, Ma Y. The in vivo anabolic actions of prostaglandins in bone. Bone. 1997;21(4):297-304.
23. Schelling S. Role of the osteoclast in prostaglandin E2-stimulated bone resorption: a correlative morphometric and biochemical analysis. Lab. Invest. 1980;42:290-5.
24. Proffit W, Fields Jr H, Sarver D, 2014. Contemporary orthodontics. 15. Atlanta: Elsevier Health Sciences.
25. Kanzaki H, Chiba M, Shimizu Y, et all. Periodontal ligament cells under mechanical stress induce osteoclastogenesis by receptor activator of nuclear factor κB ligand up-regulation via prostaglandin E2 synthesis. *J Bone Miner Res.*2002; 17(2):210-220.
26. Yamasaki K, Shibata Y, Fukuhara T, 1982. The effect of prostaglandins on experimental tooth movement in monkeys (Macaca fuscata). *J Dent Res.* 1982:61; 12:1444-1446.
27. Leiker BJ, Nanda RS, Currier GF, et all, 1995. The effects of exogenous prostaglandins on orthodontic tooth movement in rats. *Am J Orthod Dentofacial Orthop*.1995;108(4):380-388.
28. Yamasaki K, Shibata Y, Imai S, et all. Clinical application of prostaglandin E1 (PGE1) upon orthodontic tooth movement. *Am J Orthod Dentofacial Orthop*.1984;85(6):508-18.
29. Polat Ö, Aİ Karaman. Ortodontik diş hareketi ve biyokimyasal ajanlar. *Türk Ortodonti Dergisi*. 2004;17(1):140-7.
30. Kalia S, Melsen B, Verna C. Tissue reaction to orthodontic tooth movement in acute and chronic corticosteroid treatment. *Orthod Craniofac Res.2004*;7(1):26-34.
31. Atik E, Ciğer S. İlaçların ortodontik diş hareketi üzerindeki etkileri. *Ege Üniversitesi Diş Hekimliği Fakültesi Dergisi*. 2012;33(1):13-20.
32. Ashcraft MB, Southard KA, Tolley EA. The effect of corticosteroid-induced osteoporosis on orthodontic tooth movement. *Am J Orthod Dentofacial Orthop.1992;*102(4) 310-309.
33. Ong CK, Walsh LJ, Harbrow D, et all. Orthodontic tooth movement in the prednisolone-treated rat. *Angle Orthod*.2000;70(2):118-125.
34. Shinoda Y, Kawaguchi H, Higashikawa A, et all. Mechanisms underlying catabolic and anabolic functions of parathyroid hormone on bone by combination of culture systems of mouse cells. *J. Cell. Biochem.2010;*109: 4:755-763.
35. Potts JT, Gardella TJ. Progress, paradox, and potential: parathyroid hormone research over five decades. *Ann N Y Acad Sci.* 2007;1117(1):196-208.
36. Gianelly AA. Force-induced changes in the vascularity of the periodontal ligament. *Am J Orthod Dentofacial Orthop*.1969;55(1):5-11.
37. Goldie RS, King GJ. Root resorption and tooth movement in orthodontically treated, calcium-deficient, and lactating rats *Am J Orthod Dentofacial Orthop*.1984; 85(5):424-430.

38. Li F, Li G, Hu H,et all. Effect of parathyroid hormone on experimental tooth movement in rats. *Am J Orthod Dentofacial Orthop*. 2013; 144(4):523-532.
39. Norman AW. Actinomycin D and the response to vitamin D. *Science.*1965;149(3680):184-186.
40. Takano-Yamamoto T, Kawakami M, Yamashiro T. Effect of age on the rate of tooth movement in combination with local use of 1, 25 (OH) 2D3 and mechanical force in the rat. *J Dent Res.*1992;71(8):1487-1492.
41. Shetty A, Patil A, Ameet R, Sandhu P. Local infiltration of vitamin D3 does not accelerate orthodontic tooth movement in humans: a preliminary study. *Angle Orthod*, 2015:000-000
42. Tyrovola JB, Spyropoulos MN. Effects of drugs and systemic factors on orthodontic treatment. Quintessence Int.2001; 32(5).
43. Kobayashi Y, Takagi H, Sakai H, et all. Effects of local administration of osteocalcin on experimental tooth movement. *Angle Orthod*.1998;68(3): 259-266.
44. Hashimoto F, Kobayashi Y, Mataki S, et all. Administration of osteocalcin accelerates orthodontic tooth movement induced by a closed coil spring in rats. *Eur. J Orthod.2001;*23(5):535-45.
45. Brennan P, Thomas G, Langdon J. The role of nitric oxide in oral diseases. *Arch. Oral Biol.*2003;48(2):93-100.
46. Shirazi M, Nilforoushan D, Alghasi H, Dehpour A-R, 2002. The role of nitric oxide in orthodontic tooth movement in rats. *Angle Orthod*.2002;72(3): 211-215.
47. Akın E, Gurton AU, Ölmez H. Effects of nitric oxide in orthodontic tooth movement in rats. *Am J Orthod Dentofacial Orthop*. 2004;126(5): 608-614.
48. Nicozisis JL, Nah-Cederquist HD, Tuncay OC. Relaxin affects the dentofacial sutural tissues. *Clinical orthodontics and research.*2000;3(4):192-201.
49. Bumann A, Carvalho R, Schwarzer C, et all. Collagen synthesis from human PDL cells following orthodontic tooth movement. *Eur. J Orthod.*1997:19(1):29-37.
50. Han G, He H, Hua X, et all. Expression of cathepsin K and IL-6 mRNA in root-resorbing tissue during tooth movement in rats. *Zhonghua Kou Qiang Yi Xue Za Zhi.*2004;39(4):320-323.
51. Liu ZJ, King GJ, Gu GM,et all. Does human relaxin accelerate orthodontic tooth movement in rats? *Ann N Y Acad Sci*. 2005;1041(1):388-394.
52. Masella RS, Meister M. Current concepts in the biology of orthodontic tooth movement. *Am J Orthod Dentofacial Orthop*.2006;129(4):458-468.
53. Marx RE. Platelet-rich plasma (PRP): what is PRP and what is not PRP? *Implant Dent.* 2001;10(4):225-228.
54 Anila S, Nandakumar K. Applications of platelet rich plasma for regenerative therapy in periodontics. *Trends Biomater Artif Organs*.2006;20(1):78-84.
55. Mannai C .Early implant loading in severely resorbed maxilla using xenograft, autograft, and platelet-rich plasma in 97 patients. Journal of oral and maxillofacial surgery, 2006;64, 9, 1420-6.
56. Anand U, Mehta D. Evaluation of immediately loaded dental implants bioactivated with platelet-rich plasma placed in the mandibular posterior region: A clinico-radiographic study. Journal of Indian Society of Periodontology 2012; 16, 1, 89.
57. Harnack L, Boedeker R, Kurtulus I, et all. Use of platelet-rich plasma in periodontal surgery—a prospective randomised double blind clinical trial. Clinical oral investigations 2009; 13, 2, 179-87.

58. Özdemir B, Ökte E. Treatment of intrabony defects with beta-tricalciumphosphate alone and in combination with platelet-rich plasma. Journal of Biomedical Materials Research Part B: Applied Biomaterials, 2012; 100, 4, 976-83.
59. Peerbooms JC, Colaris JW, Hakkert AA et all. No positive bone healing after using platelet rich plasma in a skeletal defect. An observational prospective cohort study. International orthopaedics 2012; 36, 10, 2113-9.
60. Kokkinos PP, Shaye R, Alam BS et all. Dietary lipids, prostaglandin E2 levels, and tooth movement in alveolar bone of rats. Calcified tissue international 1993; 53, 5, 333-7.
61. Iwami-Morimoto Y, Yamaguchi K, Tanne K. Influence of dietary n-3 polyunsaturated fatty acid on experimental tooth movement in rats. The Angle Orthodontist 1999; 69, 4, 365-71.
62. Kau CH, Nguyen JT, English J. The clinical evaluation of a novel cyclical force generating device in orthodontics. Orthodontic Practice US 2010; 1, 1, 10-5.
63. Nimeri G, Kau CH, Abou-Kheir NS et all. Acceleration of tooth movement during orthodontic treatment-a frontier in orthodontics. Progress in orthodontics 2013; 14, 1, 1-8.
64. Zengo A, Bassett C, Pawluk R et all. In vivo bioelectric potentials in the dentoalveolar complex. American journal of orthodontics 1974; 66, 2, 130-9.
65. Rubin C, Turner AS, Bain S, et all. Low mechanical signals strengthen long bones. Nature 2001; 412, 6847, 603-4.
66. Andrade Jr I, Sousa ABdS, Silva GGd. New therapeutic modalities to modulate orthodontic tooth movement. Dental press journal of orthodontics 2014; 19, 123-33.
67. Liu D. Acceleration of orthodontic tooth movement by mechanical vibration. AADR Annual meeting Washington DC 2010.
68. Leethanakul C, Suamphan S, Jitpukdeebodintra S et all. Vibratory stimulation increases interleukin-1 beta secretion during orthodontic tooth movement. The Angle Orthodontist 2016; 86, 1, 74-80.
69. Miles P, Smith H, Weyant R et all. The effects of a vibrational appliance on tooth movement and patient discomfort: a prospective randomised clinical trial. Australian orthodontic journal 2012; 28, 2, 213-8.
70. Woodhouse N, DiBiase A, Johnson N et all.. Supplemental vibrational force during orthodontic alignment: a randomized trial. Journal of dental research 2015; 94, 5, 682-9.
71. Yadav S, Dobie T, Assefnia A et all. Effect of low-frequency mechanical vibration on orthodontic tooth movement. American Journal of Orthodontics and Dentofacial Orthopedics 2015; 148, 3, 440-9.
72. Pavlin D, Anthony R, Raj V et all. Cyclic loading (vibration) accelerates tooth movement in orthodontic patients: a double-blind, randomized controlled trial. Seminars in Orthodontics, 187-94.
73. Kalajzic Z, Peluso EB, Utreja A et all. Effect of cyclical forces on the periodontal ligament and alveolar bone remodeling during orthodontic tooth movement. The Angle Orthodontist 2014; 84, 2, 297-303.
74. Friedenberg Z, Harlow M, Brighton C. Healing of nonunion of the medial malleolus by means of direct current: a case report. Journal of Trauma and Acute Care Surgery 1971; 11, 10, 883-5.

75. Kawata T, Hirota K, Sumitani K et all. A new orthodontic force system of magnetic brackets. American Journal of Orthodontics and Dentofacial Orthopedics 1987; 92, 3, 241-8.
76. Blechman AM. Magnetic force systems in orthodontics: clinical results of a pilot study. American Journal of Orthodontics 1985; 87, 3, 201-10.
77. Graber T. Magnetos and impacted canines: north croft memorial lecture. Manchester: British Society for the Study of Orthodontics 1998.
78. Vig K. Taking stock: a century of orthodontics–has excellence been redefined as expediency? Orthodontics & Craniofacial Research 2004; 7, 3, 138-42.
79. Kim Y-D, Kim S-S, Kim S-J et all. Low-level laser irradiation facilitates fibronectin and collagen type I turnover during tooth movement in rats. Lasers in medical science 2010; 25, 1, 25-31.
80. Yamaguchi M, Hayashi M, Fujita S et all. Low-energy laser irradiation facilitates the velocity of tooth movement and the expressions of matrix metalloproteinase-9, cathepsin K, and alpha (v) beta (3) integrin in rats. The European Journal of Orthodontics 2010; 32, 2, 131-9.
81. Kim Y-S, Kim S-J, Yoon H-J et all. Effect of piezopuncture on tooth movement and bone remodeling in dogs. American Journal of Orthodontics and Dentofacial Orthopedics 2013; 144, 1, 23-31.
82. Fujita S, Yamaguchi M, Utsunomiya T et all. Low-energy laser stimulates tooth movement velocity via expression of RANK and RANKL. Orthodontics & craniofacial research 2008; 11, 3, 143-55.
83. Trelles M, Mayayo E. Bone fracture consolidates faster with low-power laser. Lasers in surgery and medicine 1987; 7, 1, 36-45.
84. Saito S, Shimizu N. Stimulatory effects of low-power laser irradiation on bone regeneration in midpalatal suture during expansion in the rat. American Journal of Orthodontics and Dentofacial Orthopedics 1997; 111, 5, 525-32.
85. Takeda Y. Irradiation effect of low-energy laser on alveolar bone after tooth extraction. Experimental study in rats. International journal of oral and maxillofacial surgery 1988; 17, 6, 388-91.
86. Altan BA, Sokucu O, Ozkut MM et all. Metrical and histological investigation of the effects of low-level laser therapy on orthodontic tooth movement. Lasers in medical science 2012; 27, 1, 131-40.
87. da Silva Sousa MV, Scanavini MA, Sannomiya EK et all. Influence of low-level laser on the speed of orthodontic movement. Photomedicine and Laser surgery 2011; 29, 3, 191-6.
88. Genc G, Kocadereli I, Tasar F et all. Effect of low-level laser therapy (LLLT) on orthodontic tooth movement. Lasers in medical science 2013; 28, 1, 41-7.
89. Cruz DR, Kohara EK, Ribeiro MS et all. Effects of low-intensity laser therapy on the orthodontic movement velocity of human teeth: A preliminary study. Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery 2004; 35, 2, 117-20.
90. Yamaguchi M. RANK/RANKL/OPG during orthodontic tooth movement. Orthodontics & craniofacial research 2009; 12, 2, 113-9.
91. Yamada Y, Ando F, Niino N. Association of polymorphisms of the osteoprotegerin gene with bone mineral density in Japanese women but not men. Molecular Genetics and metabolism 2003; 80, 3, 344-9.

92. Zwerina J, Hayer S, Redlich K. Activation of p38 MAPK is a key step in tumor necrosis factor–mediated inflammatory bone destruction. Arthritis & Rheumatism: Official Journal of the American College of Rheumatology 2006; 54, 2, 463-72.
93. Kanzaki H, Chiba M, Takahashi I. Local OPG gene transfer to periodontal tissue inhibits orthodontic tooth movement. Journal of dental research 2004; 83, 12, 920-5.
94. Verna C. Regional acceleratory phenomenon. Tooth Movement 2016; 18, 28-35.
95. Frost HM. The regional acceleratory phenomenon: a review. Henry Ford Hospital Medical Journal 1983; 31, 1, 3-9.
96. Bichlmayr A. Chirurgische kieferorthopadie und das Verhalten des Knochens und der Wurzelspitzen nach derselben. Dtsch. Zahnarztl. Wochenschr. 1931; 34, 835-42.
97. Köle H. Surgical operations on the alveolar ridge to correct occlusal abnormalities. Oral Surgery, Oral Medicine, Oral Pathology 1959; 12, 5, 515-29.
98. Shenava S, Nayak K, Bhaskar V et all. Accelerated orthodontics-a review. International Journal of Scientific Study 2014; 1, 5, 35-9.
99. Sebaoun J, Ferguson DJ, Wilcko MT et all. Alveolar osteotomy and rapid orthodontic treatments. L'Orthodontie francaise 2007; 78, 3, 217-25.
100. Aboul SMBE-D, El-Beialy AR, El-Sayed KMF et all. Miniscrew implant-supported maxillary canine retraction with and without corticotomy-facilitated orthodontics. American journal of orthodontics and dentofacial orthopedics 2011; 139, 2, 252-9.
101. Wilcko WM, Ferguson DJ, Bouquot J et all. Rapid orthodontic decrowding with alveolar augmentation: case report. World Journal of Orthodontics 2003; 4, 3.
102. Wilcko MT, Wilcko WM, Bissada NF. An evidence-based analysis of periodontally accelerated orthodontic and osteogenic techniques: a synthesis of scientific perspectives. Seminars in Orthodontics 2008; 305-16.
103. Murphy KG, Wilcko MT, Wilcko WM et all. Periodontal accelerated osteogenic orthodontics: a description of the surgical technique. Journal of Oral and Maxillofacial Surgery 2009; 67, 10, 2160-6.
104. Cağlaroğlu M, Erdem A. Histopathologic investigation of the effects of prostaglandin E2 administered by different methods on tooth movement and bone metabolism. The korean journal of orthodontics 2012; 42, 3, 118-28.
105. Park Y, Kang S, Kim S. Accelerated tooth movement by corticision as an osseous orthodontic paradigm. Kinki Tokai Kyosei Shika Gakkai Gakujyutsu Taikai, Sokai 2006; 48, 6, 6-15.
106. Kim S-J, Park Y-G, Kang S-G. Effects of corticision on paradental remodeling in orthodontic tooth movement. The Angle Orthodontist 2009; 79, 2, 284-91.
107. TV A. Piezocision: a minimally invasive, periodontally accelerated orthodontic tooth movement procedure. Compendium 2009; 30, 6.
108. Keser EI, Dibart S. Sequential piezocision: a novel approach to accelerated orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics 2013; 144, 6, 879-89.
109. Gün IO. Piezoinsizyon'Un Ortodontik Kanin Distalizasyonu Hızına Olan Etkisinin Incelenmesi, Marmara Universitesi (Turkey),2014.
110. Aksakalli S, Calik B, Kara B et all . Accelerated tooth movement with piezocision and its periodontal-transversal effects in patients with Class II malocclusion. The Angle Orthodontist 2016; 86, 1, 59-65.
111. Dibart S, Keser E, Nelson D. Piezocision™-assisted orthodontics: Past, present, and future. Seminars in Orthodontics 2015, 170-5.

112. Keser EI, Dibart S. Piezocision-assisted Invisalign treatment. Compendium,2011
113. Khanna R, Tikku T, Sachan K et all. Evaluation of canine retraction following periodontal distraction using NiTi coil spring and implants–A clinical study. journal of oral biology and craniofacial research 2014; 4, 3, 192-9.
114. Sukurica Y, Karaman A, Gürel HG et all. Rapid canine distalization through segmental alveolar distraction osteogenesis. The Angle orthodontist 2007; 77, 2, 226-36.
115. Sayın S, Bengi AO, Gürton AU et all. Rapid canine distalization using distraction of the periodontal ligament: a preliminary clinical validation of the original technique. The Angle Orthodontist 2004; 74, 3, 304-15.
116. Suya H. Corticotomy in orthodontics. Mechanical and biological basics in orthodontic therapy.1991.
117. Yaffe A, Fine N, Binderman I. Regional accelerated phenomenon in the mandible following mucoperiosteal flap surgery. Journal of periodontology 1994; 65, 1, 79-83.
118. Gadakh SB, Gulve N, Patani S et all. Methods of Accelerating orthodontic treatment–A Review. Journal Of Applied Dental and Medical Sciences 2016; 2, 1.
119. Alikhani M, Raptis M, Zoldan B et all. Effect of micro-osteoperforations on the rate of tooth movement. American Journal of Orthodontics and Dentofacial Orthopedics 2013; 144, 5, 639-48.
120. Teixeira C, Khoo E, Tran J et all. Cytokine expression and accelerated tooth movement. Journal of dental research 2010; 89, 10, 1135-41.

Bölüm 11

AĞIZ İÇİ MOLAR DİSTALİZASYON YÖNTEMLERİ

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GİRİŞ

Sınıf II kapanış bozuklukları, ortodonti pratiğinde klinisyenlerin yaygın olarak karşılaştıkları iskeletsel ve/veya dental nedenlerden kaynaklanan uyumsuzluklardır. Bishara dişsel Sınıf II kapanış bozukluğunun etiyolojisini, dentoalveolar bir uyumsuzluğa bağlı olarak maksiller dişlerin önde konumlanması veya süt dişinin konjenital eksikliği ya da erken kaybı nedeniyle maksiller birinci büyük azı dişlerinin daha fazla meziale doğru hareket etmesinden kaynaklandığını belirtmektedir. İskeletsel uyumsuzluğu olmayan dental Sınıf II kapanış bozukluğu olan bireylerde tedavi, üst posterior dişlerin distalizasyonu veya diş çekimli bir tedaviyi içermektedir. Günümüz ortodontik tedavi pratiğinde eğilim, diş çekimli ortodontik tedaviden diş çekimi içermeyen ortodontik tedavilere doğru evrilmekte, bu doğrultuda yeni tedavi modelleri geliştilmektedir.

Molar distalizasyon yöntemlerinden ilki, Kingsley ve Angle tarafından kullanılan headgearlerdir. Ağız dışı distalizasyon apareylerinin en önemli sınırlılıkları hasta uyumu gerektirmeleri, estetik olmayan görüntüleri, kuvvetin aralıklı olması nedeniyle diş hareketinin daha yavaş olması ve distalizasyonun daha uzun sürede gerçekleşmesidir. Bu olumsuz faktörler nedeniyle hasta uyumu gerektirmeyen, sürekli kuvvet uygulayan, kısa sürede distalizasyon sağlayan ağız içi distalizasyon yöntemleri gün geçtikçe daha çok ön plana çıkmaktadır.

İntraoral molar distalizasyon yöntemlerinde temel prensip bir bölgeden ankraj sağlanarak hedef bölgedeki dişleri hareket ettirmektir. Ancak üst molar dişlerin distalizasyonu sırasında bazı istenmeyen sonuçlar meydana gelmiş, bunları ortadan kaldırmak için de birbirini takip eden yeni uygulamalar ortodonti literatürüne kazandırılmıştır. Kitabımızın bu bölümünde mevcut literatür

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4.3.9. Zigomatik Mini Vida/Mini Plak Destekli Molar Distalizasyonu

Maksillada mini vida ve mini plak yerleştirmek amacıyla tavsiye edilen en stabililitesi yüksek ve anatomik olarak güvenli alanlardan biri zigomatik butress bölgesidir. Karma dişlenme döneminde olan hastalarda süren dişleri zararlı olmayacak konumda ve kortikal kemik yapısının kalın olması sebebiyle ankraj almak için tercih edilebilir. Fakat zigomatik bölgeye mini vida veya mini plak uygulamalarının gerektirdiği cerrahi prosedür, anatomik lokasyonun zor olması nedeniyle, tercihi kısıtlıdır.

Mostafa ve ark. (110) araştırmalarında, 20 hastaya Zigomatik Buttress'e mini vida uygulamış ve büyük azıların distal hareketini gerçekleştirmişlerdir. Üst dişlere kalın köşeli ve devamlı ark teli uygulaması yapılmıştır. Arkın üzerine lateralin distali ve moların mesiali arasına jig bükülmüştür. Mini vida ve jik arasına close coil asılmıştır ve 300 gram distal kuvvet elde edilmiştir. Tedavi sonucuna göre molar dişlerde 2,92 mm distale hareket ve üst keserlerde 1,89 mm vertikal gömülme gözlenmiştir. Ayrıca maksillada 2,08° saat yönünün tersine rotasyon görülmüştür.

SONUÇ

Ağız dışı distalizasyon yöntemlerinin estetik olmaması ve hasta uyumu gerektirmesi ağız içi distalizasyon yöntemlerinin gelişmesine yönlendirmiştir. Ağız içi molar distalizasyon yöntemleri estetik sorun yaratmaması, hasta uyumu gerektirmemesi, sürekli kuvvet uygulayarak tedavi süresini kısaltması gibi avantajlara sahiptir. Bunun yanında vaka seçiminde göz önünde bulundurulması gereken bazı dezavantajları da mevcuttur. Maksiler molar dişlerde rotasyon ve distale devrilme, ankraj alınan küçük azılarda mezial hareket ve tiping, kesicilerde protrüzyon, overjet artışı ve overbite azalması, premolar ve molar dişlerde ekstrüzyon; ankraj için alt arktan destek alındığında alt dişlerde mezializasyon ve protrüzyon oluşmaktadır. Bu dezavantajların önüne geçmek için son yıllarda minivida destekli ağız içi distalizasyon aygıtları popüler olmuştur. En isabetli tedavi yöntemi seçimi, vakanın ihtiyaçları göz önünde bulundurularak yapılan tedavi olacaktır.

KAYNAKLAR

1. Angle EH. Classification of malocclusion. Dent Cosmos. 1899;41:350-75.
2. Angle EH. Treatment of Malocclusion of the Teeth: Angle's System. Greatly Enl. and Entirely Rewritten, with Six Hundred and Forty-One Illustrations: SS White dental manufacturing Company; 1907.

3. Katz MI. Angle classification revisited 2: a modified Angle classification. American Journal of Orthodontics and Dentofacial Orthopedics. 1992;102(3):277-84.
4. Ackerman JL, Proffit WR. The characteristics of malocclusion: a modern approach to classification and diagnosis. American journal of orthodontics. 1969;56(5):443-54.
5. Jarabak JR, Fizzell JA. Technique and treatment with light-wire edgewise appliances: CV Mosby Company; 1972.
6. Moyers RE, Riolo ML, Guire KE, Wainright RL, Bookstein FL. Differential diagnosis of Class II malocclusions: Part 1. Facial types associated with Class II malocclusions. American journal of orthodontics. 1980;78(5):477-94.
7. Bishara SE. Textbook of orthodontics: Universitas Muhammadiyah Semarang; 2001.
8. McNamara Jr JA. Components of Class II malocclusion in children 8–10 years of age. The Angle Orthodontist. 1981;51(3):177-202.
9. Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics: Elsevier Health Sciences; 2006.
10. Coben SE. Growth and Class II treatment. American Journal of Orthodontics. 1966;52(1):5-26.
11. Bowman SJ, Johnston Jr LE. The esthetic impact of extraction and nonextraction treatments on Caucasian patients. The Angle Orthodontist. 2000;70(1):3-10.
12. Zierhut EC, Joondeph DR, Artun J, Little RM. Long-term profile changes associated with successfully treated extraction and nonextraction Class II Division 1 malocclusions. The Angle Orthodontist. 2000;70(3):208-19.
13. Kinzinger GS, Eren M, Diedrich PR. Treatment effects of intraoral appliances with conventional anchorage designs for non-compliance maxillary molar distalization. A literature review. The European Journal of Orthodontics. 2008;30(6):558-71.
14. Kingsley NW. A treatise on oral deformities as a branch of mechanical surgery: D. Appleton; 1880.
15. Angle E. Malocclusion of the Teeth and Fractures of the Maxillae. Philadelphia, PA: The SS White Dental Manufacturing Company. 1900.
16. Oppenheim A. Biologic orthodontic therapy and reality. The Angle Orthodontist. 1936;6(2):69-116.
17. Kloehn SJ. Guiding alveolar growth and eruption of teeth to reduce treatment time and produce a more balanced denture and face. The Angle Orthodontist. 1947;17(1):10-33.
18. Ülgen M. Ortodonti; Anomaliler, Sefolometri, Etiyoloji, Büyüme ve Gelişim, Tanı. 2000.
19. Armstrong MM. Controlling the magnitude, direction, and duration of extraoral force. American journal of orthodontics. 1971;59(3):217-43.
20. Melsen B. Effects of cervical anchorage during and after treatment: an implant study. American Journal of Orthodontics. 1978;73(5):526-40.
21. Firouz M, Zernik J, Nanda R. Dental and orthopedic effects of high-pull headgear in treatment of Class II, division 1 malocclusion. American Journal of Orthodontics and Dentofacial Orthopedics. 1992;102(3):197-205.
22. Üçem TT, Yükselb S. Effects of different vectors of forces applied by combined headgear. American journal of orthodontics and dentofacial orthopedics. 1998;113(3):316-23.
23. Samuels RH, Jones ML. Orthodontic facebow injuries and safety equipment. The European Journal of Orthodontics. 1994;16(5):385-94.

24. Holland GN, Wallace DA, Mondino BJ, Cole SH, Ryan SJ. Severe ocular injuries from orthodontic headgear. Archives of ophthalmology. 1985;103(5):649-51.
25. Nanda R. Biomechanics and esthetic strategies in clinical orthodontics: Elsevier Health Sciences; 2005.
26. Poulton DR. The influence of extraoral traction. American journal of orthodontics. 1967;53(1):8-18.
27. Jeckel N, Rakosi T. Molar distalization by intra-oral force application. The European Journal of Orthodontics. 1991;13(1):43-6.
28. Cetlin NM. Nonextraction treatment. J Clin Orthod. 1983;17:396-413.
29. Akin E, Gurton AU, Sagdic D. Effects of a segmented removable appliance in molar distalization. The European Journal of Orthodontics. 2006;28(1):65-73.
30. Keles A, Pamukcu B, Tokmak EC. Bilateral Maxillary Molar Distalization with Sliding Mechanics: Keles Slider. World Journal of Orthodontics. 2002;3(1).
31. Gianelly AA, Vaitaa AS, Thomas WM. The use of magnets to move molars distally. American Journal of Orthodontics and Dentofacial Orthopedics. 1989;96(2):161-7.
32. Hilgers JJ. The pendulum appliance for Class II non-compliance therapy. J Clin orthod. 1992;26:706-14.
33. Bondemark L, Kurol J. Distalization of maxillary first and second molars simultaneously with repelling magnets. The European Journal of Orthodontics. 1992;14(4):264-72.
34. Blechman AM, Smiley H. Magnetic force in orthodontics. American Journal of Orthodontics. 1978;74(4):435-43.
35. Blechman AM. Magnetic force systems in orthodontics: clinical results of a pilot study. American Journal of Orthodontics. 1985;87(3):201-10.
36. Itoh T, Tokuda T, Kiyosue S, Hirose T, Matsumoto M, Chaconas S. Molar distalization with repelling magnets. Journal of Clinical Orthodontics: JCO. 1991;25(10):611-7.
37. Erverdi N, Koyutürk Ö, Küçükkeles N. Nickel-titanium coil springs and repelling magnets: a comparison of two different intra-oral molar distalization techniques. British Journal of orthodontics. 1997;24(1):47-53.
38. Gianelly AA, Bednar J, Dietz VS. Japanese NiTi coils used to move molars distally. American Journal of Orthodontics and Dentofacial Orthopedics: Official Publication of the American Association of Orthodontists, its Constituent Societies, and the American Board of Orthodontics. 1991;99(6):564-6.
39. Pieringer M, Droschl H, Permann R. Distalization with a Nance appliance and coil springs. Journal of clinical orthodontics: JCO. 1997;31(5):321-6.
40. Miura F, Mogi M, Ohura Y, Karibe M. The super-elastic Japanese NiTi alloy wire for use in orthodontics part III. Studies on the Japanese NiTi alloy coil springs. American Journal of Orthodontics and Dentofacial Orthopedics. 1988;94(2):89-96.
41. Bondemark L, Kurol J, Bernhold M. Repelling magnets versus superelastic nickel-titanium coils in simultaneous distal movement of maxillary first and second molars. The Angle Orthodontist. 1994;64(3):189-98.
42. Gündüz E, Crismani A, Bantleon H, Hönigl KD, Zachrisson BU. An improved transpalatal bar design. Part II. Clinical upper molar derotation—case report. The Angle Orthodontist. 2003;73(3):244-8.
43. Gündüz E, Zachrisson BU, Hönigl KD, Crismani A, Bantleon H. An improved transpalatal bar design. Part I. Comparison of moments and forces delivered by two bar

designs for symmetrical molar derotation. The Angle Orthodontist. 2003;73(3):239-43.
44. Haas SE, Cisneros GJ, editors. The goshgarian transpalatal bar: A clinicaland an experimental investigation. Seminars in Orthodontics; 2000: Elsevier.
45. Byloff FK, Darendeliler MA. Distal molar movement using the pendulum appliance. Part 1: clinical and radiological evaluation. The Angle Orthodontist. 1997;67(4):249-60.
46. Reiner TJ. Modified Nance appliance for unilateral molar distalization. Journal of Clinical Orthodontics: JCO. 1992;26(7):402-4.
47. Ghosh J, Nanda RS. Evaluation of an intraoral maxillary molar distalization technique. American Journal of Orthodontics and Dentofacial Orthopedics. 1996;110(6):639-46.
48. Byloff FK, Darendeliler MA, Clar E, Darendeliler A. Distal molar movement using the pendulum appliance. Part 2: the effects of maxillary molar root uprighting bends. The Angle Orthodontist. 1997;67(4):261-70.
49. Bussick TJ, McNamara Jr JA. Dentoalveolar and skeletal changes associated with the pendulum appliance. American Journal of Orthodontics and Dentofacial Orthopedics. 2000;117(3):333-43.
50. Toroğlu M, Uzel I, Cam O, Hancioğlu Z. Cephalometric evaluation of the effects of pendulum appliance on various vertical growth patterns and of the changes during short-term stabilization. Clinical Orthodontics and Research. 2001;4(1):15-27.
51. Taner TU, Yukay F, Pehlivanoglu M, Çakırer B. A comparative analysis of maxillary tooth movement produced by cervical headgear and pend-x appliance. The Angle Orthodontist. 2003;73(6):686-91.
52. Shashidhar NR, Reddy SRK, Rachala MR. Comparison of K-loop molar distalization with that of pendulum appliance-a prospective comparative study. Journal of Clinical and Diagnostic Research: JCDR. 2016;10(6):ZC20.
53. Hilgers JJ, Tracey SG. The mini-distalizing appliance: the third dimension in maxillary expansion. Journal of clinical orthodontics: JCO. 2003;37(9):467-75.
54. Kinzinger GS, Fritz UB, Sander F-G, Diedrich PR. Efficiency of a pendulum appliance for molar distalization related to second and third molar eruption stage. American Journal of Orthodontics and Dentofacial Orthopedics. 2004;125(1):8-23.
55. Chiu PP, McNamara Jr JA, Franchi L. A comparison of two intraoral molar distalization appliances: distal jet versus pendulum. American Journal of Orthodontics and Dentofacial Orthopedics. 2005;128(3):353-65.
56. Fuziy A, de Almeida RR, Janson G, Angelieri F, Pinzan A. Sagittal, vertical, and transverse changes consequent to maxillary molar distalization with the pendulum appliance. American journal of orthodontics and dentofacial orthopedics. 2006;130(4):502-10.
57. Patel MP, Janson G, Henriques JFC, de Almeida RR, de Freitas MR, Pinzan A, et al. Comparative distalization effects of Jones jig and pendulum appliances. American journal of orthodontics and dentofacial orthopedics. 2009;135(3):336-42.
58. Acar AG, Gürsoy S, Dinçer M. Molar distalization with a pendulum appliance K-loop combination. The European Journal of Orthodontics. 2010;32(4):459-65.
59. Caprioglio A, Beretta M, Lanteri C. Maxillary molar distalization: Pendulum and Fast-Back, comparison between two approaches for Class II malocclusion. Progress in orthodontics. 2011;12(1):8-16.

60. Locatelli R. Molar distalization with superelastic Ni-Ti wire. J Clin Orthod. 1992;26:277-9.
61. Giancotti A, Cozza P. Nickel titanium double-loop system for simultaneous distalization of first and second molars. Journal of clinical orthodontics: JCO. 1998;32(4):255-60.
62. Gianelly AA. Distal movement of the maxillary molars. American Journal of Orthodontics and Dentofacial Orthopedics. 1998;114(1):66-72.
63. Jones R, White J. Rapid Class II molar correction with an open-coil jig. Journal of clinical orthodontics: JCO. 1992;26(10):661-4.
64. Gulati S, Kharbanda O, Parkash H. Dental and skeletal changes after intraoral molar distalization with sectional jig assembly. American journal of orthodontics and dentofacial orthopedics. 1998;114(3):319-27.
65. Runge ME, Martin JT, Bukai F. Analysis of rapid maxillary molar distal movement without patient cooperation. American journal of orthodontics and dentofacial orthopedics. 1999;115(2):153-7.
66. Haydar S, Üner O. Comparison of Jones jig molar distalization appliance with extraoral traction. American Journal of Orthodontics and Dentofacial Orthopedics. 2000;117(1):49-53.
67. Brickman CD, Sinha PK, Nanda RS. Evaluation of the Jones jig appliance for distal molar movement. American journal of orthodontics and dentofacial orthopedics. 2000;118(5):526-34.
68. Kalra V. The K-loop molar distalizing appliance. Journal of clinical orthodontics: JCO. 1995;29(5):298-301.
69. Greenfield RL. Fixed piston appliance for rapid Class II correction. J Clin Orthod. 1995;29:174-83.
70. Carano A. The distal jet for upper molar distalization. J Clin Orthod. 1996;30:374-80.
71. Ngantung V, Nanda RS, Bowman SJ. Posttreatment evaluation of the distal jet appliance. American journal of orthodontics and dentofacial orthopedics. 2001;120(2):178-85.
72. Bolla E, Muratore F, Carano A, Bowman SJ. Evaluation of maxillary molar distalization with the distal jet: a comparison with other contemporary methods. The angle orthodontist. 2002;72(5):481-94.
73. Fortini A, Lupoli M, Parri M. The first class appliance for rapid molar distalization. Journal of clinical orthodontics: JCO. 1999;33(6):322-8.
74. Kırçelli B. First Class apareyinin etkilerinin Pendulum apareyi ile karşılaştırılması. Çukurova Üniversitesi Sağlık Bilimleri Enstitüsü Ortodonti Anabilim Dalı: Doktora tezi, Adana; 2003.
75. Fortini A, Lupoli M, Giuntoli F, Franchi L. Dentoskeletal effects induced by rapid molar distalization with the first class appliance. American Journal of Orthodontics and Dentofacial Orthopedics. 2004;125(6):697-704.
76. Papadopoulos MA, Melkos AB, Athanasiou AE. Noncompliance maxillary molar distalization with the first class appliance: a randomized controlled trial. American Journal of Orthodontics and Dentofacial Orthopedics. 2010;137(5):586. e1-. e13.
77. Keles A, Sayinsu K. A new approach in maxillary molar distalization: intraoral bodily molar distalizer. American Journal of Orthodontics and Dentofacial Orthopedics. 2000;117(1):39-48.

78. Scott M. Molar distalization: more ammunition for your operatory. Oral Health. 1996;86(9):7-10, 3.
79. Keles A. Maxillary unilateral molar distalization with sliding mechanics: a preliminary investigation. The European Journal of Orthodontics. 2001;23(5):507-15.
80. İkbal A. Ağız içi molar distalizasyonunda kullanılan Keleş Slider ve Jones Jig aparyellerinin karşılaştırılması. 2004.
81. Sayinsu K, Isik F, Allaf F, Arun T. Unilateral molar distalization with a modified slider. The European Journal of Orthodontics. 2006;28(4):361-5.
82. Mavropoulos A, Sayinsu K, Allaf F, Kiliaridis S, Papadopoulos MA, Keles AO. Noncompliance unilateral maxillary molar distalization: a three-dimensional tooth movement analysis. The Angle Orthodontist. 2006;76(3):382-7.
83. Veltri N, Veltri N, Baldini A. Slow sagittal and bilateral palatal expansion for the treatmentof class II malocclusions. Leone Bollettino International. 2001;3:5-9.
84. Bacetti T. A new appliance for molar distalization. Reprinted from
Ortho News. 2001:1:2-6.
85. Walde KC. The simplified molar distalizer. Journal of Clinical Orthodontics: JCO. 2003;37(11):616-9; quiz 26.
86. Bayram M, Nur M, Kilkis D. The frog appliance for upper molar distalization: a case report. Korean Journal of Orthodontics. 2010;40(1):50-60.
87. Wilson W, Wilson R. New treatment dimensions with first phase sectional and progressive edgewise mechanics. Journal of clinical orthodontics: JCO. 1980;14(9):607-27.
88. Wilson W, Wilson R. Multi-directional 3D functional Class II treatment. Journal of clinical orthodontics: JCO. 1987;21(3):186-9.
89. Kucukkeles N, Cakirer B, Mowafi M. Cephalometric evaluation of molar distalization by hyrax screw used in conjunction with a lip bumper. World journal of orthodontics. 2006;7(3).
90. Carano A, Velo S, Incorvati C, Poggio P. Clinical applications of the Mini-Screw-Anchorage-System (MAS) in the maxillary alveolar bone. Progress in orthodontics. 2004;5(2):212-35.
91. Takaki T, Tamura N, Yamamoto M, Takano N, Shibahara T, Yasumura T, et al. Clinical study of temporary anchorage devices for orthodontic treatment. The Bulletin of Tokyo Dental College. 2010;51(3):151-63.
92. Shapiro PA, Kokich VG. Uses of implants in orthodontics. Dental Clinics of North America. 1988;32(3):539-50.
93. Nienkemper M, Wilmes B, Pauls A, Yamaguchi S, Ludwig B, Drescher D. Treatment efficiency of mini-implant-borne distalization depending on age and second-molar eruption. Springer; 2014.
94. Ryu J-H, Park JH, Thu TVT, Bayome M, Kim Y, Kook Y-A. Palatal bone thickness compared with cone-beam computed tomography in adolescents and adults for mini-implant placement. American Journal of Orthodontics and Dentofacial Orthopedics. 2012;142(2):207-12.
95. Wilmes B, Drescher D. A miniscrew system with interchangeable abutments. Journal of clinical orthodontics: JCO. 2008;42(10):574-95.
96. Wilmes B, Drescher D. Application and effectiveness of the Beneslider: a device to move molars distally. World J Orthod. 2010;11(4):331-40.
97. Ludwig B, Glasl B, Kinzinger G, Walde KC, Lisson JA. The skeletal frog appliance for

maxillary molar distalization. Journal of clinical orthodontics: JCO. 2011;45(2):77-84; quiz 91.
98. Hourfar J, Ludwig B, Kanavakis G. An active, skeletally anchored transpalatal appliance for derotation, distalization and vertical control of maxillary first molars. Journal of Orthodontics. 2014;41(1_suppl):s24-s32.
99. Kinzinger GS, Gülden N, Yildizhan F, Diedrich PR. Efficiency of a skeletonized distal jet appliance supported by miniscrew anchorage for noncompliance maxillary molar distalization. American journal of orthodontics and dentofacial orthopedics. 2009;136(4):578-86.
100. Gelgor IE, Karaman AI, Buyukyilmaz T. Use of the intraosseous screw for unilateral upper molar distalization and found well balanced occlusion. Head & Face Medicine. 2006;2(1):1-6.
101. Ertugay E. Molar Dişlerin Distalizasyonu Sırasında Oluşturduğu DİŞsel ve İskeletsel Etkilerin Karşılaştırılması Gazi Üniversitesi. 2002.
102. Kaan E. Mikro-implant destekli modifiye lokar apareyinin ortodontik bölgeye etkisi. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü Ortodonti Anabilim Dalı: Doktora tezi, Ankara; 2007.
103. Kircelli BH, Pektaş Z, Kircelli C. Maxillary molar distalization with a bone-anchored pendulum appliance. The Angle Orthodontist. 2006;76(4):650-9.
104. Escobar SA, Tellez PA, Moncada CA, Villegas CA, Latorre CM, Oberti G. Distalization of maxillary molars with the bone-supported pendulum: a clinical study. American Journal of Orthodontics and Dentofacial Orthopedics. 2007;131(4):545-9.
105. Keles A, Erverdi N, Sezen S. Bodily distalization of molars with absolute anchorage. The Angle Orthodontist. 2003;73(4):471-82.
106. Papadopoulos MA. Orthodontic treatment of Class II malocclusion with miniscrew implants. American Journal of Orthodontics and Dentofacial Orthopedics. 2008;134(5):604. e1-. e16.
107. Yamada K, Kuroda S, Deguchi T, Takano-Yamamoto T, Yamashiro T. Distal movement of maxillary molars using miniscrew anchorage in the buccal interradicular region. The Angle Orthodontist. 2009;79(1):78-84.
108. Lim S-M, Hong R-K. Distal movement of maxillary molars using a lever-arm and mini-implant system. The Angle Orthodontist. 2008;78(1):167-75.
109. Oberti G, Villegas C, Ealo M, Palacio JC, Baccetti T. Maxillary molar distalization with the dual-force distalizer supported by mini-implants: a clinical study. American Journal of Orthodontics and Dentofacial Orthopedics. 2009;135(3):282. e1-. e5.
110. El-Dawlatly MM, Abou-EL-Ezz AM, El-Sharaby FA, Mostafa YA. Zygomatic mini-implant for Class II correction in growing patients. Springer; 2014.

Bölüm 12

OBSTRÜKTİF UYKU APNESİ TEDAVİSİ İÇİN ORTOGNATİK CERRAHİ

Hatice BAŞARANLAR BAL[1]
Celal IRGIN[2]

1.GİRİŞ

Obstrüktif Uyku Apnesi Sendromu (OSA), uyku sırasında tekrarlayan kesintili solunum atakları ile karakterize edilen bir uyku bozukluğudur. Tipik olarak boğazın arkasındaki yumuşak doku uyku sırasında çöktüğünde, hava yolunun fiziksel olarak tıkanmasından kaynaklanır. OSA'nın kesin prevalansı bilinmemekle birlikte, taranan popülasyonlarda %2 ila %14 arasında değişmektedir. Erkeklerin OSA'ya sahip olma olasılığı kadınlardan üç kat daha fazladır. Obez olmayan premenopozal kadınlarda özellikle nadirdir; ancak hormon tedavisi almayan menopoz sonrası kadınlarda OSA oranları, benzer yaş ve vücut kitle indeksine sahip erkeklerde OSA oranlarına yaklaşmaktadır. OSA prevalansı, özellikle 60 yaşın üzerindeki kişilerde yaşla birlikte artar. OSA ayrıca obez kişiler arasında daha yaygındır. Hem yaşlanan bir nüfus hem de artan obezite oranı, bir toplumdaki artmış OSA oranına katkıda bulunur. OSA yetişkinlerde daha sık gözlenen bir hastalık olsa da çocuklarda da görülebilmektedir (1, 2). Çocukların %1 ila %5'inde belgelenmiştir. Bu, kandaki oksijen seviyelerinin düşmesine yol açar ve bu da çeşitli sağlık sorunlarına neden olabilir. Bu durumun bilişsel davranış, mesleki yetersizlik ve serebrovasküler ve kardiyovasküler hastalık gibi daha kötü tıbbi komorbiditeler üzerinde önemli bir etkisi olabilir (3). 1985'ten önce OSA, yalnızca kulak burun boğaz ve akciğer tıbbının tıbbi uzmanlık alanları tarafından araştırılan ve tedavi edilen bir hastalıktı. Her geçen yıl, daha fazla hastaya teşhis kondukça ve bu obstrüktif hava yolu hastalığının etkisi arttıkça, prevalansı ürkütücü bir hızla arttı. Kardiyovasküler sistem sorunları, kronik gündüz uyku hali ile ilişkili sosyal sorunlar, gece meydana gelen ani ölüm gibi

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KAYNAKÇA

1. Sacchetti LM, Mangiardi P. Obstructive sleep apnea: causes, treatment and health implications: Nova Science Publishers; 2012.
2. Semelka M, Wilson J, Floyd R. Diagnosis and treatment of obstructive sleep apnea in adults. American family physician. 2016;94(5):355-60.
3. Dempsey JA, Xie A, Patz DS, Wang D. Physiology in medicine: obstructive sleep apnea pathogenesis and treatment—considerations beyond airway anatomy. Journal of applied physiology. 2014;116(1):3-12.
4. White DP. Advanced concepts in the pathophysiology of obstructive sleep apnea. Sleep-Related Breathing Disorders. 80: Karger Publishers; 2017. p. 7-16.
5. e Sousa RAC, dos Santos Gil NA. Craniofacial skeletal architecture and obstructive sleep apnoea syndrome severity. Journal of Cranio-Maxillofacial Surgery. 2013;41(8):740-6.
6. Riley RW, Powell NB, Li KK, Troell RJ, Guilleminault C. Surgery and obstructive sleep apnea: long-term clinical outcomes. Otolaryngology—Head and Neck Surgery. 2000;122(3):415-21.
7. Holty J-EC, Guilleminault C. Maxillomandibular advancement for the treatment of obstructive sleep apnea: a systematic review and meta-analysis. Sleep medicine reviews. 2010;14(5):287-97.
8. Andrews BT, Lakin GE, Bradley JP, Kawamoto Jr HK. Orthognathic surgery for obstructive sleep apnea: applying the principles to new horizons in craniofacial surgery. Journal of Craniofacial Surgery. 2012;23(7):S96-S9.
9. Miloro M, Ghali G, Larsen PE, Waite PD. Peterson's principles of oral and maxillofacial surgery: Springer; 2004.
10. Sakakibara H, Tong M, Matsushita K, Hirata M, Konishi Y, Suetsugu S. Cephalometric abnormalities in non-obese and obese patients with obstructive sleep apnoea. European Respiratory Journal. 1999;13(2):403-10.
11. Zaghi S, Holty J-EC, Certal V, Abdullatif J, Guilleminault C, Powell NB, et al. Maxillomandibular advancement for treatment of obstructive sleep apnea: a meta-analysis. JAMA Otolaryngology–Head & Neck Surgery. 2016;142(1):58-66.
12. Agha B, Johal A. Facial phenotype in obstructive sleep apnea–hypopnea syndrome: a systematic review and meta-analysis. Journal of sleep research. 2017;26(2):122-31.
13. Mattos C, Vilani G, Sant'Anna E, Ruellas A, Maia L. Effects of orthognathic surgery on oropharyngeal airway: a meta-analysis. International journal of oral and maxillofacial surgery. 2011;40(12):1347-56.
14. Medicine AOSATFotAAoS. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. Journal of clinical sleep medicine. 2009;5(3):263-76.
15. Kapur VK, Auckley DH, Chowdhuri S, Kuhlmann DC, Mehra R, Ramar K, et al. Clinical practice guideline for diagnostic testing for adult obstructive sleep apnea: an American Academy of Sleep Medicine clinical practice guideline. Journal of Clinical Sleep Medicine. 2017;13(3):479-504.
16. Riley R, Guilleminault C, Herran J, Powell N. Cephalometric analyses and flow-volume loops in obstructive sleep apnea patients. Sleep. 1983;6(4):303-11.
17. Stuck BA, Maurer JT. Airway evaluation in obstructive sleep apnea. Sleep medicine reviews. 2008;12(6):411-36.

18. Koutsourelakis I, Safiruddin F, Ravesloot M, Zakynthinos S, de Vries N. Surgery for obstructive sleep apnea: sleep endoscopy determinants of outcome. The Laryngoscope. 2012;122(11):2587-91.
19. Vanderveken O, Hoekema A. How to treat patients that do not tolerate continuous positive airway pressure. Breathe 7 (2): 157–167. 2010.
20. Zhou N, Ho J-PT, Spijker R, Aarab G, De Vries N, Ravesloot MJ, et al. Maxillomandibular Advancement and Upper Airway Stimulation for Treatment of Obstructive Sleep Apnea: A Systematic Review. Journal of Clinical Medicine. 2022;11(22):6782.
21. Visscher WP, Ho J-PT, Zhou N, Ravesloot MJ, Schulten EA, Lange Jd, et al. Development and Internal Validation of a Prediction Model for Surgical Success of Maxillomandibular Advancement for the Treatment of Moderate to Severe Obstructive Sleep Apnea. Journal of Clinical Medicine. 2023;12(2):503.
22. Martin MJ, Khanna A, Srinivasan D, Sovani MP. Patient-reported outcome measures following maxillomandibular advancement surgery in patients with obstructive sleep apnoea syndrome. British Journal of Oral and Maxillofacial Surgery. 2022;60(7):963-8.
23. Liu SY-C, Riley RW, Yu MS. Surgical algorithm for obstructive sleep apnea: an update. Clinical and Experimental Otorhinolaryngology. 2020;13(3):215-24.
24. Huon L-K, Liu SY-C, Shih TT-F, Chen Y-J, Lo M-T, Wang P-C. Dynamic upper airway collapse observed from sleep MRI: BMI-matched severe and mild OSA patients. European Archives of Oto-Rhino-Laryngology. 2016;273:4021-6.
25. Liu SYC, Huon LK, Lo MT, Chang YC, Capasso R, Chen YJ, et al. Static craniofacial measurements and dynamic airway collapse patterns associated with severe obstructive sleep apnoea: a sleep MRI study. Clinical Otolaryngology. 2016;41(6):700-6.
26. Barrera JE. Sleep magnetic resonance imaging: dynamic characteristics of the airway during sleep in obstructive sleep apnea syndrome. The Laryngoscope. 2011;121(6):1327-35.
27. Kezirian EJ, Hohenhorst W, de Vries N. Drug-induced sleep endoscopy: the VOTE classification. European Archives of Oto-Rhino-Laryngology. 2011;268:1233-6.
28. Butterfield KJ, Marks PL, McLean L, Newton J. Quality of life assessment after maxillomandibular advancement surgery for obstructive sleep apnea. Journal of Oral and Maxillofacial Surgery. 2016;74(6):1228-37.
29. Abramson Z, Susarla S, August M, Troulis M, Kaban L. Three-dimensional computed tomographic analysis of airway anatomy in patients with obstructive sleep apnea. Journal of Oral and Maxillofacial Surgery. 2010;68(2):354-62.
30. Tangugsorn V, Skatvedt O, Krogstad O, Lyberg T. Obstructive sleep apnoea: a cephalometric study. Part I. Cervico-craniofacial skeletal morphology. The European Journal of Orthodontics. 1995;17(1):45-56.
31. Banabilh SM, Suzina A, Dinsuhaimi S, Singh G. Cranial base and airway morphology in adult malays with obstructive sleep apnoea. Australian orthodontic journal. 2007;23(2):89-95.
32. Jacobson A. The "Wits" appraisal of jaw disharmony. American journal of orthodontics. 1975;67(2):125-38.
33. Kikuchi M, Higurashi N, Miyazaki S, Itasaka Y. Facial patterns of obstructive sleep apnea patients using Ricketts' method. Psychiatry and clinical neurosciences. 2000;54(3):336-7.

34. Rosario HD, Oliveira GMS, Freires IA, de Souza Matos F, Paranhos LR. Efficiency of bimaxillary advancement surgery in increasing the volume of the upper airways: a systematic review of observational studies and meta-analysis. European Archives of Oto-rhino-laryngology. 2017;274:35-44.
35. Hochban W, Brandenburg U. Morphology of the viscerocranium in obstructive sleep apnoea syndrome-cephalometric evaluation of 400 patients. Journal of Cranio-Maxillofacial Surgery. 1994;22(4):205-13.
36. Battagel J, L'estrange P. The cephalometric morphology of patients with obstructive sleep apnoea (OSA). European journal of orthodontics. 1996;18(6):557-69.
37. Hwang S, Chung CJ, Choi Y-J, Huh J-K, Kim K-H. Changes of hyoid, tongue and pharyngeal airway after mandibular setback surgery by intraoral vertical ramus osteotomy. The Angle Orthodontist. 2010;80(2):302-8.
38. Hochban W, Schürmann R, Brandenburg U. Mandibular setback for surgical correction of mandibular hyperplasia—does it provoke sleep-related breathing disorders? International journal of oral and maxillofacial surgery. 1996;25(5):333-8.
39. He J, Wang Y, Hu H, Liao Q, Zhang W, Xiang X, et al. Impact on the upper airway space of different types of orthognathic surgery for the correction of skeletal class III malocclusion: A systematic review and meta-analysis. International Journal of Surgery. 2017;38:31-40.
40. Chen F, Terada K, Hua Y, Saito I. Effects of bimaxillary surgery and mandibular setback surgery on pharyngeal airway measurements in patients with Class III skeletal deformities. American journal of orthodontics and dentofacial orthopedics. 2007;131(3):372-7.
41. Degerliyurt K, Ueki K, Hashiba Y, Marukawa K, Nakagawa K, Yamamoto E. A comparative CT evaluation of pharyngeal airway changes in class III patients receiving bimaxillary surgery or mandibular setback surgery. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2008;105(4):495-502.
42. Kitagawara K, Kobayashi T, Goto H, Yokobayashi T, Kitamura N, Saito C. Effects of mandibular setback surgery on oropharyngeal airway and arterial oxygen saturation. International journal of oral and maxillofacial surgery. 2008;37(4):328-33.
43. Lye KW. Effect of orthognathic surgery on the posterior airway space (PAS). Ann Acad Med Singapore. 2008;37(8):677-82.
44. Tan SK, Leung WK, Tang ATH, Zwahlen RA. Effects of mandibular setback with or without maxillary advancement osteotomies on pharyngeal airways: an overview of systematic reviews. PloS one. 2017;12(10):e0185951.
45. Foltán R, Rybínová K. The impact of mandibular advancement on the upper airway patterns—cephalometric study. Prague Med Rep. 2007;108(2):147-54.
46. Achilleos S, Krogstad O, Lyberg T. Surgical mandibular advancement and changes in uvuloglossopharyngeal morphology and head posture: a short-and long-term cephalometric study in males. The European Journal of Orthodontics. 2000;22(4):367-81.
47. Hoshijima M, Honjo T, Moritani N, Iida S, Yamashiro T, Kamioka H. Maxillary advancement for unilateral crossbite in a patient with sleep apnea syndrome. Acta Medica Okayama. 2015;69(3):177-82.
48. Jain S, Muthusekhar M, Baig M, Senthilnathan P, Loganathan S, Wahab P. UA, Madhulakshmi, M., Vohra, Y. 2019. Evaluation of Three-Dimensional Changes in Pharyngeal Airway Following Isolated Lefort One Osteotomy for the Correction of

Vertical Maxillary Excess: A Prospective Study. Journal of Maxillofacial and Oral Surgery.18(1):139-46.
49. Waite P, Wooten V, Lachner J, Guyette R. Maxillomandibular advancement surgery in 23 patients with obstructive sleep apnea syndrome. Journal of oral and maxillofacial surgery. 1989;47(12):1256-61.
50. Prinsell JR. Maxillomandibular advancement surgery in a site-specific treatment approach for obstructive sleep apnea in 50 consecutive patients. Chest. 1999;116(6):1519-29.
51. Boyd SB. Management of obstructive sleep apnea by maxillomandibular advancement. Oral and Maxillofacial Surgery Clinics. 2009;21(4):447-57.
52. Caples SM, Rowley JA, Prinsell JR, Pallanch JF, Elamin MB, Katz SG, et al. Surgical modifications of the upper airway for obstructive sleep apnea in adults: a systematic review and meta-analysis. Sleep. 2010;33(10):1396-407.
53. Boyd SB, Walters AS, Waite P, Harding SM, Song Y. Long-term effectiveness and safety of maxillomandibular advancement for treatment of obstructive sleep apnea. Journal of Clinical Sleep Medicine. 2015;11(7):699-708.
54. Boyd SB, Walters AS, Song Y, Wang L. Comparative effectiveness of maxillomandibular advancement and uvulopalatopharyngoplasty for the treatment of moderate to severe obstructive sleep apnea. Journal of Oral and Maxillofacial Surgery. 2013;71(4):743-51.
55. Cillo Jr JE, Dattilo DJ, editors. Orthognathic surgery for obstructive sleep apnea. Seminars in Orthodontics; 2019: Elsevier.
56. Lin CC-H, Wang P-f, Loh SRH, Lau HT, Hsu SS-P. Maxillomandibular rotational advancement: airway, aesthetics, and angle's considerations. Sleep Medicine Clinics. 2019;14(1):83-9.
57. Liao Y-F, Chiu Y-T, Lin C-H, Chen Y-A, Chen N-H, Chen Y-R. Modified maxillomandibular advancement for obstructive sleep apnoea: towards a better outcome for Asians. International Journal of Oral and Maxillofacial Surgery. 2015;44(2):189-94.
58. Powers DB, Allan PF, Hayes CJ, Michaelson PG. A review of the surgical treatment options for the obstructive sleep apnea/hypopnea syndrome patient. Military medicine. 2010;175(9):676-85.
59. Schendel SA, Broujerdi JA, Jacobson RL. Three-dimensional upper-airway changes with maxillomandibular advancement for obstructive sleep apnea treatment. American Journal of Orthodontics and Dentofacial Orthopedics. 2014;146(3):385-93.
60. Butterfield KJ, Marks PL, McLean L, Newton J. Linear and volumetric airway changes after maxillomandibular advancement for obstructive sleep apnea. Journal of Oral and Maxillofacial Surgery. 2015;73(6):1133-42.
61. Sittitavornwong S, Waite PD, Shih AM, Cheng GC, Koomullil R, Ito Y, et al. Computational fluid dynamic analysis of the posterior airway space after maxillomandibular advancement for obstructive sleep apnea syndrome. Journal of Oral and Maxillofacial Surgery. 2013;71(8):1397-405.
62. Hsieh Y-J, Liao Y-F. Effects of maxillomandibular advancement on the upper airway and surrounding structures in patients with obstructive sleep apnoea: a systematic review. British Journal of Oral and Maxillofacial Surgery. 2013;51(8):834-40.
63. Susarla SM, Abramson ZR, Dodson TB, Kaban LB. Upper airway length decreases after maxillomandibular advancement in patients with obstructive sleep apnea. Journal of oral and maxillofacial surgery. 2011;69(11):2872-8.

64. Mehra P, Downie M, Pita MC, Wolford LM. Pharyngeal airway space changes after counterclockwise rotation of the maxillomandibular complex. American Journal of Orthodontics and Dentofacial Orthopedics. 2001;120(2):154-9.
65. Lee W-J, Hwang D-H, Liu SY-C, Kim S-J. Subtypes of maxillomandibular advancement surgery for patients with obstructive sleep apnea. Journal of Craniofacial Surgery. 2016;27(8):1965-70.
66. Wolford LM, Chemello PD, Hilliard F. Occlusal plane alteration in orthognathic surgery—Part I: Effects on function and esthetics. American Journal of Orthodontics and Dentofacial Orthopedics. 1994;106(3):304-16.
67. Knudsen TB, Laulund AS, Ingerslev J, Homøe P, Pinholt EM. Improved apnea-hypopnea index and lowest oxygen saturation after maxillomandibular advancement with or without counterclockwise rotation in patients with obstructive sleep apnea: a meta-analysis. Journal of Oral and Maxillofacial Surgery. 2015;73(4):719-26.
68. Maganzini AL, Alhussain IY. Treatment of obstructive sleep apnea with combined orthognathic-orthodontic approach assessed by nocturnal polysomnography. New York State Dental Journal. 2008;74(3):36.
69. Torres HM, Valladares-Neto J, Torres ÉM, Freitas RZ, Silva MAG. Effect of genioplasty on the pharyngeal airway space following maxillomandibular advancement surgery. Journal of Oral and Maxillofacial Surgery. 2017;75(1):189. e1-. e12.
70. Dattilo DJ, Drooger SA. Outcome assessment of patients undergoing maxillofacial procedures for the treatment of sleep apnea: comparison of subjective and objective results. Journal of oral and maxillofacial surgery. 2004;62(2):164-8.
71. Goodday RH, Bourque SE, Edwards PB. Objective and subjective outcomes following maxillomandibular advancement surgery for treatment of patients with extremely severe obstructive sleep apnea (apnea-hypopnea index> 100). Journal of Oral and Maxillofacial Surgery. 2016;74(3):583-9.
72. John C, Gandhi S, Sakharia A, James T. Maxillomandibular advancement is a successful treatment for obstructive sleep apnoea: a systematic review and meta-analysis. International journal of oral and maxillofacial surgery. 2018;47(12):1561-71.
73. Douglas NJ, Thomas S, Jan MA. Clinical value of polysomnography. The Lancet. 1992;339(8789):347-50.
74. Giarda M, Brucoli M, Arcuri F, Benech R, Braghiroli A, Benech A. Efficacy and safety of maxillomandibular advancement in treatment of obstructive sleep apnoea syndrome. Acta Otorhinolaryngologica Italica. 2013;33(1):43.
75. Aurora RN, Casey KR, Kristo D, Auerbach S, Bista SR, Chowdhuri S, et al. Practice parameters for the surgical modifications of the upper airway for obstructive sleep apnea in adults. Sleep. 2010;33(10):1408-13.
76. Rossi DS, Goker F, Cullati F, Baj A, Pignatelli D, Gianni AB, et al. Post-Operative Patients' Satisfaction and Quality of Life Assessment in Adult Patients with Obstructive Sleep Apnea Syndrome (OSAS). International Journal of Environmental Research and Public Health. 2022;19(10):6273.
77. Smatt Y, Ferri J. Retrospective study of 18 patients treated by maxillomandibular advancement with adjunctive procedures for obstructive sleep apnea syndrome. Journal of Craniofacial Surgery. 2005;16(5):770-7.
78. Veys B, Pottel L, Mollemans W, Abeloos J, Swennen G, Neyt N. Three-dimensional volumetric changes in the upper airway after maxillomandibular advancement in obst-

ructive sleep apnoea patients and the impact on quality of life. International journal of oral and maxillofacial surgery. 2017;46(12):1525-32.
79. Bianchi A, Betti E, Tarsitano A, Morselli-Labate AM, Lancellotti L, Marchetti C. Volumetric three-dimensional computed tomographic evaluation of the upper airway in patients with obstructive sleep apnoea syndrome treated by maxillomandibular advancement. British Journal of Oral and Maxillofacial Surgery. 2014;52(9):831-7.
80. Liu SY-C, Huon L-K, Powell NB, Riley R, Cho HG, Torre C, et al. Lateral pharyngeal wall tension after maxillomandibular advancement for obstructive sleep apnea is a marker for surgical success: observations from drug-induced sleep endoscopy. Journal of Oral and Maxillofacial Surgery. 2015;73(8):1575-82.
81. Kim S-J, Kim KB. Orthodontics in Obstructive Sleep Apnea Patients: A Guide to Diagnosis, Treatment Planning, and Interventions: Springer Nature; 2019.
82. Jung J, Moon S-H, Kwon Y-D. Current status of surgery-first approach (part III): the use of 3D technology and the implication in obstructive sleep apnea. Maxillofacial Plastic and Reconstructive Surgery. 2020;42(1):1-8.
83. Peiro-Guijarro MA, Guijarro-Martinez R, Hernandez-Alfaro F. Surgery first in orthognathic surgery: a systematic review of the literature. American Journal of Orthodontics and Dentofacial Orthopedics. 2016;149(4):448-62.
84. Hochban W, Brandenburg U, Peter JH. Surgical treatment of obstructive sleep apnea by maxillomandibular advancement. Sleep. 1994;17(7):624-9.
85. Reiche-Fischel O, Wolford L. Posterior airway space changes after double jaw surgery with counter-clockwise rotation. J Oral Maxillofac Surg. 1996;54(suppl 1):96.
86. Lee SH, Kaban LB, Lahey ET. Skeletal stability of patients undergoing maxillomandibular advancement for treatment of obstructive sleep apnea. Journal of Oral and Maxillofacial Surgery. 2015;73(4):694-700.
87. Cillo Jr JE, Dattilo DJ. Maxillomandibular advancement for severe obstructive sleep apnea is a highly skeletally stable long-term procedure. Journal of Oral and Maxillofacial Surgery. 2019;77(6):1231-6.
88. Li KK, Riley RW, Powell NB, Guilleminault C. Patient's perception of the facial appearance after maxillomandibular advancement for obstructive sleep apnea syndrome. Journal of oral and maxillofacial surgery. 2001;59(4):377-80.
89. Farrell BB, Tucker MR. Safe, efficient, and cost-effective orthognathic surgery in the outpatient setting. Journal of oral and maxillofacial surgery. 2009;67(10):2064-71.
90. Cillo Jr JE, Dattilo DJ. Early major medical complications after surgical management of obstructive sleep apnea: a retrospective cohort analysis and case series. Journal of Oral and Maxillofacial Surgery. 2015;73(1):123-8.
91. Boyd SB, Chigurupati R, Cillo Jr JE, Eskes G, Goodday R, Meisami T, et al. Maxillomandibular advancement improves multiple health-related and functional outcomes in patients with obstructive sleep apnea: a multicenter study. Journal of Oral and Maxillofacial Surgery. 2019;77(2):352-70.
92. Robl MT, Farrell BB, Tucker MR. Complications in orthognathic surgery: a report of 1000 cases. Oral and Maxillofacial Surgery Clinics. 2014;26(4):599-609.
93. Kim Y-K. Complications associated with orthognathic surgery. Journal of the Korean Association of Oral and Maxillofacial Surgeons. 2017;43(1):3-15.
94. McComb RW, Marrinan EM, Nuss RC, LaBrie RA, Mulliken JB, Padwa BL. Predictors of velopharyngeal insufficiency after Le Fort I maxillary advancement in patients with cleft palate. Journal of oral and maxillofacial surgery. 2011;69(8):2226-32.

95. Wu Y, Wang X, Ma L, Li Z. Velopharyngeal configuration changes following Le Fort I osteotomy with maxillary advancement in patients with cleft lip and palate: a cephalometric study. The Cleft Palate-Craniofacial Journal. 2015;52(6):711-6.
96. Chanchareonsook N, Samman N, Whitehill TL. The effect of cranio-maxillofacial osteotomies and distraction osteogenesis on speech and velopharyngeal status: a critical review. The Cleft palate-craniofacial journal. 2006;43(4):477-87.
97. Li KK, Troell RJ, Riley RW, Powell NB, Koester U, Guilleminault C. Uvulopalatopharyngoplasty, maxillomandibular advancement, and the velopharynx. The Laryngoscope. 2001;111(6):1075-8.
98. Hendler BH, Costello BJ, Silverstein K, Yen D, Goldberg A. A protocol for uvulopalatopharyngoplasty, mortised genioplasty, and maxillomandibular advancement in patients with obstructive sleep apnea: an analysis of 40 cases. Journal of oral and maxillofacial surgery. 2001;59(8):892-7.
99. Bettega G, Pepin J-L, Veale D, Deschaux C, Raphael B, Levy P. Obstructive sleep apnea syndrome: fifty-one consecutive patients treated by maxillofacial surgery. American journal of respiratory and critical care medicine. 2000;162(2):641-9.
100. Proffit WR, Turvey TA, Phillips C. The hierarchy of stability and predictability in orthognathic surgery with rigid fixation: an update and extension. Head & face medicine. 2007;3(1):1-11.
101. Li KK, Powell NB, Riley RW, Troell RJ, Guilleminault C. Long-term results of maxillomandibular advancement surgery. Sleep and Breathing. 2000;4(03):137-40.
102. Bothur S, Blomqvist JE, Isaksson S. Stability of Le Fort I osteotomy with advancement: a comparison of single maxillary surgery and a two-jaw procedure. Journal of oral and maxillofacial surgery. 1998;56(9):1029-33.
103. Ellis III E, Gallo WJ. Relapse following mandibular advancement with dental plus skeletal maxillomandibular fixation. Journal of Oral and Maxillofacial Surgery. 1986;44(7):509-15.
104. Van Sickels JE. A comparative study of bicortical screws and suspension wires versus bicortical screws in large mandibular advancements. Journal of oral and maxillofacial surgery. 1991;49(12):1293-6.
105. Posnick JC, Adachie A, Singh N, Choi E. "Silent" sleep apnea in dentofacial deformities and prevalence of daytime sleepiness after orthognathic and intranasal surgery. Journal of Oral and Maxillofacial Surgery. 2018;76(4):833-43.
106. Aubry C, Bouchard C, Paris M, Sauvé C. Satisfaction with Facial Appearance following Bimaxillary Orthognathic Surgery. Journal of Oral and Maxillofacial Surgery. 2021;79(10):e19-e20.
107. Lee KJC, Tan SL, Low HYA, Chen LJ, Yong CW, Chew MT. Accuracy of 3-dimensional soft tissue prediction for orthognathic surgery in a Chinese population. Journal of Stomatology, Oral and Maxillofacial Surgery. 2022;123(5):551-5.
108. Tsui WK, Yang Y, Cheung LK, Leung YY. Distraction osteogenesis as a treatment of obstructive sleep apnea syndrome: a systematic review. Medicine. 2016;95(36):e4674.
109. Tsui WK, Yang Y, Mcgrath C, Leung YY. Mandibular distraction osteogenesis versus sagittal split ramus osteotomy in managing obstructive sleep apnea: a randomized clinical trial. Journal of Cranio-Maxillofacial Surgery. 2019;47(5):750-7.

Bölüm 13

OBSTRÜKTİF UYKU APNESİ VE ORTODONTİ

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GİRİŞ

Obstrüktif uyku apnesi (OUA) kısmi veya tam üst hava yolu obstrüksiyonu ile karakterize normal solunumu ve uyku düzenini bozan, uzun süreli bir hastalıktır. Günümüzde yaygın olarak görülen ve yaşam kalitesini düşüren bir sağlık sorunudur. Yetişkinlerde görüldüğü gibi pediatrik popülasyonda da görülmektedir. OUA teşhisi temel bir öneme sahip olamakla birlikte tedavisi farklı uzmanlık alanlarını içeren iş birliği gerektirmektedir. Diş hekimi ve ortodontistler de OUA tanı ve tedavi ekibinin bir parçası olmalıdır. Çeneler arası ilişkilerin düzeltilmesi ve dentofasiyal estetiğin sağlanmasıyla ilgilenen ortodonti, klinik ve radyolojik değerlendirme yöntemleriyle OUA tanısında önemli rol oynamaktadır. Ayrıca erken dönem ortodontik tedaviler, ağız içi aparey kullanımı ve ortognatik cerrahi gibi tedavi yöntemlerini kullanarak OUA tedavisine multidisipliner olarak katkı sağlar.

TANIM VE GÖRÜLME SIKLIĞI

OUA, American Academy of Sleep Medicine (AASM)' nin hazırladığı, uluslararası uyku bozuklukları sınıflamasına göre "uyku sırasında tekrarlayan tam veya kısmen üst solunum yolu obstrüksiyonu ile karakterize, sıklıkla kan oksijen satürasyonunda azalma ve genellikle uykudan uyanmalar" şeklinde tanımlanmaktadır (1). Apne hava akışının tamamen durması iken hipopne ise hava akışının kısmi olarak (%30-50) azalmadır (2). Uyku saati başına ortalama apne ve hipopne sayısını ölçen apne-hipopne indeksi (AHI), tipik olarak hastalığın şiddetini tanımlamak için kullanılan en önemli parametrelerdendir. OUA, hafif (AHI 5-15), orta (AHI 15-30), veya şiddetli (AHI >30) olarak sınıflandırılabilir (3).

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burun solunumuyla birlikte üst solunum yolu tıkanıklığını önler (70). Bu nedenle ortodontistlerin OUA tedavisinde erken dönemde maloklüzyon ve kraniyofasiyal ortopedik sorunları tedavi ederek oluşabilecek risk faktörlerinin engellenmesinin önemi büyüktür.

SONUÇ

OUA yaygın görülen, hastaların yaşam kalitesini engelleyen ve tedavisinde multidispliner bir yaklaşım gerektiren hastalıktır. Ortodontik tedavi dental ve iskeletsel anomalileri tedavi ederek OUA için predispozan faktörlerin engellenmesinde, klinik muayene ve radyografilerle OUA tanısının tespitinde, ağız içi aparey kullanımı ve yetişkinlerde ortognatik cerrahi ile OUA tedavisinde önemli bir rol oynamaktadır.

KAYNAKÇA

1. American Academy of Sleep Medicine. Sleep-related breathing disorders in adults: Recommendations for syndrome definition and measurement techniques in clinical research. *The Report of an American Academy of Sleep Medicine Task Force*. 1999;22:667-689.
2. Haynes PL. The role of behavioral sleep medicine in the assessment and treatment of sleep disordered breathing. *Clinical Psychology Review*. 2005;25(5):673-705.
3. Shrikrishna BH, Deepa G, Sawal A, et al. Anatomical Basis of Obstructive Sleep Apnoea: A Review of Randomized Controlled Trials. *Cureus*. 2023;15(9):e44525.
4. Gresova S, Gaborova M, Stimmelova J, et al. An Obstructive Sleep Apnea - A Novel Public Health Threat. *Physiological Research*. 2023;72(4):415-423.
5. Senaratna CV, Perret JL, Lodge CJ, et al. Prevalence of obstructive sleep apnea in the general population: A systematic review. *Sleep Medicine Reviews*. 2017;34:70-81.
6. Eckert DJ, Malhotra A. Pathophysiology of adult obstructive sleep apnea. P*roceeding of American Thoracic Society*. 2008;5(2):144-153.
7. Gharibeh T, Mehra R. Obstructive sleep apnea syndrome: natural history, diagnosis, and emerging treatment options. *Nature and Science of Sleep.* 2010;2:233-255.
8. Türk Toraks Derneği. Türk toraks derneği obstrüktıif uyku apne sendromu tani ve tedavi uzlaşı raporu. *Türk Toraks Dergisi.* 2012;13:66.
9. Köktürk O. Obstrüktif uyku apne sendromu fizyopatolojisi. *Tüberküloz ve Toraks Dergisi*. 1998;46(3):288-300.
10. Gaudette E. KRJ. Pathophysiology of OSA. *European Respiratory Monograph*. 2010;50:31-50.
11. Slowik J.M. SA, Collen J.F. Obstructive Sleep Apnea. 2022. (9.10.2023 tarihinde https://www.ncbi.nlm.nih.gov/books/NBK459252/ adresinden ulaşılmıştır)
12. Robertson C. Cranial base considerations between apnoeics and non-apnoeic snorers, and associated effects of long-term mandibular advancement on condylar and natural head position. *European Journal of Orthodontics.* 2002;24(4):353-361.
13. Pirelli P, Saponara M, De Rosa C, et al. Orthodontics and obstructive sleep apnea in children. *Medical Clinics North America. 2010*;94(3):517-529.

14. Akset M, Poppe KG, Kleynen P, et al. Endocrine disorders in obstructive sleep apnoea syndrome: A bidirectional relationship. *Clinical Endocrinology*. 2023;98(1):3-13.
15. Douik El Gharbi L, Ismail I, Dhahri B, et al. [Obesity hypoventilation syndrome and obstructive sleep apnea syndrome: is there an association?]. *Le Tunise Medicale*. 2011;89(8-9):668-671.
16. Akkaya A, Öztürk Ö. Uyku Apne Sendromu Tanı Yöntemleri. *Turkiye Klinikleri Pulmonary Medicine-Special Topics*. 2008;1:50-57.
17. Uçar E, Çekiç Nagaş I. Obstrüktif Uyku Apne Sendromunda Tanı ve Tedavi Yöntemlerinde Güncel Yaklaşımlar. *Ege Üniversitesi Diş Hekimliği Fakültesi Dergisi*. 2021;42:37-48.
18. Andrews BT, Lakin GE, Bradley JP, et al. Orthognathic surgery for obstructive sleep apnea: applying the principles to new horizons in craniofacial surgery. *Journal of Craniofacial Surgery*. 2012;23(7 Suppl 1):2028-2041.
19. Ip MS, Lam KS, Ho C, et al. Serum leptin and vascular risk factors in obstructive sleep apnea. *Chest*. 2000;118(3):580-600.
20. American Academy of Sleep Medicine. International Classification of Sleep Disorders. 3rd ed. 2014.
21. Stuck BA, Maurer JT. Airway evaluation in obstructive sleep apnea. *Sleep Medicine Reviews*. 2008;12(6):411-436.
22. Johal A, Battagel JM. Current principles in the management of obstructive sleep apnoea with mandibular advancement appliances. *British Dental Journal*. 2001;190(10):532-600.
23. Battagel JM, Johal A, Kotecha B. A cephalometric comparison of subjects with snoring and obstructive sleep apnoea. *European Journal of Orthodontics*. 2000;22(4):353-365.
24. Prinsell JR. Maxillomandibular advancement surgery for obstructive sleep apnea syndrome. *The Journal of American Dental Association*. 2002;133(11):1489-97; quiz 539-540.
25. Endo S, Mataki S, Kurosaki N. Cephalometric evaluation of craniofacial and upper airway structures in Japanese patients with obstructive sleep apnea. *Journal of Research Medical and Dental Science*. 2003;50(1):109-120.
26. Yamaoka M, Furusawa K, Uematsu T, et al. Relationship of the hyoid bone and posterior surface of the tongue in prognathism and micrognathia. *Journal of Oral Rehabilitation*. 2003;30(9):914-920.
27. Pae EK, Lowe AA, Fleetham JA. A role of pharyngeal length in obstructive sleep apnea patients. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1997;111(1):12-17.
28. Andersson L, Brattstrom V. Cephalometric analysis of permanently snoring patients with and without obstructive sleep apnea syndrome. *International Journal of Oral and Maxillofacial Surgery*. 1991;20(3):159-162.
29. Tangugsorn V, Krogstad O, Espeland L, et al. Obstructive sleep apnoea: multiple comparisons of cephalometric variables of obese and non-obese patients. *Journal of Craniomaxillofac Surgery*. 2000;28(4):204-212.
30. Tangugsorn V, Skatvedt O, Krogstad O, et al. Obstructive sleep apnoea: a cephalometric study. Part I. Cervico-craniofacial skeletal morphology. *European Journal of Orthodontics*. 1995;17(1):45-56.

31. Neelapu BC, Kharbanda OP, Sardana HK, et al. Craniofacial and upper airway morphology in adult obstructive sleep apnea patients: A systematic review and meta-analysis of cephalometric studies. *Sleep Medicine Reviews*. 2017;31:79-90.
32. Hoekema A, Hovinga B, Stegenga B, et al. Craniofacial morphology and obstructive sleep apnoea: a cephalometric analysis. *Journal of Oral Rehabilitation*. 2003;30(7):690-696.
33. Attanasio R, Bailey DR. Dental Management of Sleep Disorders. USA: Wiley-Blackwell; 2010.
34. Mochizuki T, Okamoto M, Sano H, Naganuma H. Cephalometric analysis in patients with obstructive sleep apnea syndrome. *Acta Otolaryngol Supplementum*. 1996;524:64-72.
35. Chang JL, Goldberg AN, Alt JA, Mohammed A, Ashbrook L, Auckley D, et al. International Consensus Statement on Obstructive Sleep Apnea. *International Forum Allergy & Rhinol*. 2023;13(7):1061-1482.
36. Liu Y, Zeng X, Fu M, Huang X, Lowe AA. Effects of a mandibular repositioner on obstructive sleep apnea. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2000;118(3):248-256.
37. Köktürk O, Ulukavak Çiftçi T. Obstrüktif Uyku Apne Sendromu Genel Önlemler ve Medikal Tedavi. *Tüberküloz ve Toraks Dergisi.* 2002;50:119-124.
38. Köktürk O, Ulukavak Çiftçi T. Obstrüktif Uyku Apne Sendromu CPAP/BPAP Tedavisi. *Tüberküloz ve Toraks Dergisi.* 2002;50:317-334.
39. Millman RP, Rosenberg CL, Kramer NR. Oral appliances in the treatment of snoring and sleep apnea. Otolaryngol Clin North Am. 1998;31(6):1039.
40. Bahammam A, Kryger M. Decision making in obstructive sleep-disordered breathing. Putting it all together. *Clinics in Chest Medicine.* 1998;19(1):87-97.
41. Cartwright R. What's new in oral appliances for snoring and sleep apnea: an update. *Sleep Medicine Reviews*. 2001;5(1):25-32.
42. Köktürk O, Ulukavak Çiftçi T. Obstrüktif Uyku Apne Sendromu Ağızıçi Araç Tedavisi. *Tüberküloz ve Toraks Dergisi.* 2002;50:307-316.
43. Özdere E, Aykent F. The Use Of Oral Applıances In Treatment Of Snorıng And Obtructıve Sleep Apnea. *Journal Dental Faculty of Ataturk University.* 2015;11:123-128.
44. Marklund M. Starting Mandibular Advancement Device Therapy in Patients with Good Protrusive Capacity: A Randomized Pilot Study. *Turkish Journal of Orthodontics.* 2023;36(3):158-164.
45. Jayesh SR, Bhat WM. Mandibular advancement device for obstructive sleep apnea: *An overview. Journal of Pharmacy and Bioallied Sciences.* 2015;7(Suppl 1):S223-225.
46. Henke KG, Frantz DE, Kuna ST. An oral elastic mandibular advancement device for obstructive sleep apnea. *American Journal of Respiratory and Critical Care Medicine.* 2000;161(2 Pt 1):420-5.
47. George PT. Selecting sleep-disordered-breathing appliances. Biomechanical considerations. *The Journal of American Dental Assocition.* 2001;132(3):339-347.
48. Ng JH, Yow M. Oral Appliances in the Management of Obstructive Sleep Apnea. *Sleep Medicine Clinics.* 2019;14(1):109-18.
49. Ng JH, Yow M. Oral Appliances in the Management of Obstructive Sleep Apnea. Sleep Med Clin. 2020;15(2):241-250.

50. Rose E, Staats R, Virchow C, et al. A comparative study of two mandibular advancement appliances for the treatment of obstructive sleep apnoea. *European Journal of Orthodontics*. 2002;24(2):191-198.
51. Cistulli PA, Gotsopoulos H, Marklund M, et al. Treatment of snoring and obstructive sleep apnea with mandibular repositioning appliances. *Sleep Medicine Reviews*. 2004;8(6):443-457.
52. Engelke WG, Mendoza M, Repetto G. Preliminary radiographic observations of the tongue-repositioning manoeuvre. *European Journal of Orthodontics.* 2006;28(6):618-623.
53. Lye KW. Effect of orthognathic surgery on the posterior airway space (PAS). *Annals of the Academy of Medicine Singapure. 2008;37(8):677-682.*
54. Kulnis R, Nelson S, Strohl K, et al. Cephalometric assessment of snoring and nonsnoring children. *Chest*. 2000;118(3):596-603.
55. Hendler BH, Costello BJ, Silverstein K, et al. A protocol for uvulopalatopharyngoplasty, mortised genioplasty, and maxillomandibular advancement in patients with obstructive sleep apnea: an analysis of 40 cases. *Journal of Oral and Maxillofacial Surgery.* 2001;59(8):892-897.
56. Holty JE, Guilleminault C. Maxillomandibular advancement for the treatment of obstructive sleep apnea: a systematic review and meta-analysis. *Sleep Medicine Reviews*. 2010;14(5):287-97.
57. Fairburn SC, Waite PD, Vilos G, et al. Three-dimensional changes in upper airways of patients with obstructive sleep apnea following maxillomandibular advancement. *Journal of Oral and Maxillofacial Surgery.* 2007;65(1):6-12.
58. Li KK, Riley RW, Powell NB, et al. Maxillomandibular advancement for persistent obstructive sleep apnea after phase I surgery in patients without maxillomandibular deficiency. *Laryngoscope.* 2000;110(10 Pt 1):1684-1688.
59. Hochban W, Brandenburg U. Morphology of the viscerocranium in obstructive sleep apnoea syndrome--cephalometric evaluation of 400 patients. *Journal of Craniomaxillofac Surgery.* 1994;22(4):205-213.
60. Brockbank JC. Update on pathophysiology and treatment of childhood obstructive sleep apnea syndrome. *Paediatric Respiratory Reviews.* 2017;24:21-30.
61. Bariani RCB, Bigliazzi R, Cappellette Junior M, et al. Effectiveness of functional orthodontic appliances in obstructive sleep apnea treatment in children: literature review. *Brazilian Journal of Otorhinolaryngology.* 2022;88(2):263-278.
62. Behrents RG, Shelgikar AV, Conley RS, et al. Obstructive sleep apnea and orthodontics: An American Association of Orthodontists White Paper. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2019;156(1):13-28.
63. Kaditis A, Kheirandish-Gozal L, Gozal D. Algorithm for the diagnosis and treatment of pediatric OSA: a proposal of two pediatric sleep centers. *Sleep Medicine.* 2012;13(3):217-227.
64. Pirila-Parkkinen K, Lopponen H, Nieminen P, et al. Cephalometric evaluation of children with nocturnal sleep-disordered breathing. *European Journal of Orthodontics*. 2010;32(6):662-671.
65. Huynh NT, Desplats E, Almeida FR. Orthodontics treatments for managing obstructive sleep apnea syndrome in children: A systematic review and meta-analysis. *Sleep Medicine Reviews.* 2016;25:84-94.

66. Perinetti G, Primozic J, Franchi L, et al. Treatment Effects of Removable Functional Appliances in Pre-Pubertal and Pubertal Class II Patients: A Systematic Review and Meta-Analysis of Controlled Studies. *PLoS One.* 2015;10(10):e0141198.
67. Villa MP, Bernkopf E, Pagani J, et al. Randomized controlled study of an oral jaw-positioning appliance for the treatment of obstructive sleep apnea in children with malocclusion. *American Journal of Respiratory and Critical Care Medicine.* 2002;165(1):123-127.
68. Pirila-Parkkinen K, Pirttiniemi P, Nieminen P, et al. Cervical headgear therapy as a factor in obstructive sleep apnea syndrome. *Pediatric Dentistry Journal.* 1999;21(1):39-45.
69. Xie B, Zhang L, Lu Y. The role of rapid maxillary expansion in pediatric obstructive sleep apnea: Efficacy, mechanism and multidisciplinary collaboration. *Sleep Medicine Reviews.* 2023;67:101733.
70. Villa MP, Miano S, Rizzoli A. Mandibular advancement devices are an alternative and valid treatment for pediatric obstructive sleep apnea syndrome. *Sleep and Breathing.* 2012;16(4):971-976.

Bölüm 14

ELEKTRİKLİ VE MANUEL DİŞ FIRÇALARININ DENTAL PLAĞI UZAKLAŞTIRMADAKİ ETKİNLİKLERİ

Gökçen Deniz BAYRAK[1]

1. GİRİŞ

Çürük, gingivitis ve periodontitis gibi ağız hastalıklarının önlenmesinde, diş yüzeyinden dental plağın etkili bir şekilde uzaklaştırılmasının çok büyük etkisi vardır (1). Günümüzde, gelişmiş ülkelerde kişisel günlük ağız hijyen prosedürü standartlarından biri diş fırçalamaktır. Diş fırçalamanın etkili olması için kullanılan diş fırçasının ve fırçalama yönteminin doğru olması gerekmektedir (2).

2. DİŞ FIRÇASININ TARİHÇESİ

MÖ 3500'de Babil'de çiğneme çubuğu şeklinde diş fırçası keşfedilmiştir. Antimikrobiyal özelliklere sahip sakız ağacı ve zeytin ağacı gibi çeşitli ağaç türlerinin dallarından yapılan bu çubuklar, diş çürümesi ve diş eti hastalıklarının önlenmesine yardımcı olmuştur (3). Yıllar süren gelişmelerden sonra, Çin'de Tang hanedanlığı döneminde (MS 619-907) domuz kıllı diş fırçası keşfedildi (4). Domuzlardan elde edilen fırça kılları, bambu veya kemikten yapılan bir sapa eklenerek günümüzdeki diş fırçasına benzeyen bir fırça geliştirildi. Daha sonra domuz kıllı diş fırçaları Avrupa'ya yayıldı ancak Avrupalılar domuz kıllarının sert olduğunu düşünerek, at kılından veya tüyden elde edilen daha yumuşak kılları tercih ettiler (5).

1857 yılında bir diş fırçasının ilk patenti (Patent No. 18653) Amerika Birleşik Devletleri (ABD)'de H. N. Wadsworth'a verilmiş ve 1885 yılında seri üretime başlanmıştır. Diş fırçaları kemikten, fildişinden veya tahtadan yapılmış sap ve hayvan kıllarından oluşmaktaydı. Ancak kısa sürede hayvan kıllarının bakterileri kolayca tuttuğu ve kılların iyi kurumadığı anlaşıldı. 1900'lerde selüloit saplar kemik sapların yerini alırken, DuPont tarafından üretilen naylon veya diğer sentetik lifler hayvan kıllarının yerini aldı (4).

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- Elektrikli ve manuel diş fırçalarından başka farklı tiplerde diş fırçaları geliştirilmektedir. İleri çalışmalarda bu tür diş fırçalarının da dental plağı uzaklaştırmadaki etkinlikleri değerlendirilmelidir.

KAYNAKÇA

1. Axelsson S, Söder B, Nordenram G, et al. Effect of combined caries-preventive methods: a systematic review of controlled clinical trials. *Acta Odontologica Scandinavica.* 2004;62(3):163–169. doi: 10.1080/00016350410006842.
2. Tonetti MS, Eickholz P, Loos BG, et al. Principles in prevention of periodontal diseases: consensus report of group 1 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. *Journal of Clinical Periodontology.* 2015;42(16):5–11.
3. Yu HY, Qian LM, Zheng J. *Dental Biotribology.* New York: Springer;2013.
4. Kumar JV. *Oral hygiene aids. In Textbook of Preventive and Community Dentistry.* 2nd ed. India: Elsevier; 2011. pp. 412–413.
5. Panati C. *Extraordinary Origins of Everyday Things.* New York: Harper Collins; 2013. pp. 208–209.
6. Ng C, Tsoi JKH, Lo ECM, et al. Safety and Design Aspects of Powered Toothbrush-A Narrative Review. *Dentistry Journal (Basel).* 2020;8(1):15. doi: 10.3390/dj8010015.
7. Harris N, Garcia-Godoy F, Nathe C. *Primary Preventive Dentistry.* 7 ed. New Jersey: Pearson; 2009.
8. Voelker MA, Bayne SC, Liu Y, et al. Catalogue of Tooth Brush Head Designs. *Journal of Dental Hygiene.* 2013;87(3):118-133.
9. Mehta S, Sruthi Vyaasini CV, Jindal L, et al. Toothbrush, its Design and Modifications: An Overview. *Journal of Current Medical Research and Opinion.* 2020;3(8):570–578.
10. Wilkins EM. *Clinical Practice of the Dental Hygienist.* 10 ed. Baltimore: Lippincott Williams & Wilkins; 2009.
11. Atarbashi-Moghadam F, Atarbashi-Moghadam S. Tooth Brushing in Children. *Journal of Dental Materials and Techniques.* 2018;7(4):181-184.
12. Bilen YZ. Sabit ortodontik tedavi gören hastalarda akıllı diş fırçası kullanımının periodontal durum ve mine demineralizasyonu üzerine etkileri. *Pamukkale Üniversitesi Diş Hekimliği Fakültesi Ortodonti Anabilim Dalı Uzmanlık Tezi,* 2019.
13. Xu Z, Cheng X, Conde E, et al. Clinical assessment of a manuel toothbrush with CrissCross and tapered bristle technology on gingivitis ve plaque reduction. *American Journal of Dentistry.* 2019;32(3):107-112.
14. Saruttichart T, Chantarawaratit P, Leevailoj C, et al. Effectiveness of a motionless ultrasonic toothbrush in reducing plaque and gingival inflammation in patients with fixed orthodontic appliances. *Angle Orthodontist.* 2017;87(2):279–285. doi: 10.2319/042516-334.1.
15. Digel I, Kern I, Geenen EM, et al. Dental Plaque Removal by Ultrasonic Toothbrushes. *Dentistry Journal (Basel).* 2020;8(1):28. doi:10.3390/dj8010028.
16. Erbe C, Jacobs C, Klukowska M, et al. A randomized clinical trial to evaluate the plaque removal efficacy of an oscillating-rotating toothbrush versus a sonic toothbrush in orthodontic patients using digital imaging analysis of the anterior dentition. *Angle Orthodontist.* 2019;89(3):385-390. doi: 10.2319/080317-520.1.

17. Terezhalmy GT, Biesbrock AR, Walters PA, et al. Clinical evaluation of brushing time and plaque removal potential of two manual toothbrushes. *International Journal of Dental Hygiene.* 2008;6(4):321-327. doi: 10.1111/j.1601-5037.2008.00327.x.
18. Aparna KS, Puranik MP, Sowmya KR. Powered toothbrush- A review. *International Journal of Health Sciences and Research.* 2018;8(5):299-306.
19. Johnson BD, McInnes C. Clinical evaluation of the efficacy and safety of a new sonic toothbrush. *Journal of Periodontology.* 1994;65(7):692-697. doi: 10.1902/jop.1994.65.7.692.
20. Tritten CB, Armitage GC. Comparison of a sonic and a manual toothbrush for efficacy in supragingival plaque removal and reduction of gingivitis. *Journal of Clinical Periodontology.* 1996;23(7):641-648. doi: 10.1111/j.1600-051x.1996.tb00588.x.
21. Grossman E, Dembling W, Proskin HM. A comparative clinical investigation of the safety and efficacy of an oscillating/rotating electric toothbrush and a sonic toothbrush. *The Journal of clinical dentistry.* 1995;6(1):108-112.
22. Robinson PJ, Maddalozzo D, Breslin S. A six-month clinical comparison of the efficacy of the Sonicare and the Braun Oral-B electric toothbrushes on improving periodontal health in adult periodontitis patients. *The Journal of clinical dentistry.* 1997;8(1):4-9.
23. Yaacob M, Worthington HV, Deacon SA, et al. Powered versus manual toothbrushing for oral health. *Cochrane Database of Systematic Reviews.* 2014;6:CD002281. doi: 10.1002/14651858.CD002281.pub3.
24. Oral-B. https://oralb.com/ [Accessed: 15th July 2023]
25. Chandra S, Jain N, Garg R, Dhawan P, Tuli A, Kumar G. Ionic vs Manual Toothbrushes: Effect on Plaque and Oral Hygiene Status in Children. *International Journal of Clinical Pediatric Dentistry.* 2019;12(5):375-378. doi: 10.5005/jp-journals-10005-1675.
26. Mescher KD, Brine P, Billet I. Ability of elementary school children to perform sulcular toothbrushing related to their hand function ability. *Pediatric Dentistry Journal.* 1980;2(1):31-36.
27. Pasiga B. Finger brush, an alternative for removing plaque in children under five years old**.** *Journal of Dentistry Indonesia.* 2006;13(2): 221-228.
28. American Academy on Pediatric Dentistry Council on Clinical Affairs. Policy on the use of xylitol in caries prevention. *Pediatr Dentistry Journal.* 2008-2009;30(7):36-37.
29. Joshi AV, Dixit UB. Effectiveness of plaque removal with an experimental chewable brush in children between age 9 and 13 years. *European Archives of Paediatric Dentistry*. 2018;19(6):417-421. doi: 10.1007/s40368-018-0376-2.
30. Keller M, Keller G, Eller T, et al. Cleansing efficacy of an auto-cleaning toothbrushing device with nylon bristles: a randomized-controlled pilot study. *Clinical Oral Investigations.* 2023;27(2):603-611. doi: 10.1007/s00784-022-04755-9.
31. Davidovich E, Ccahuana-Vasquez RA, Timm H et al. Randomised clinical study of plaque removal efficacy of a power toothbrush in a paediatric population. *International Journal of Paediatric Dentistry.* 2017;27(6): 558–567. doi: 10.1111/ipd.12298.
32. Durhan MA, Uluakay M, Kargül B. The Plaque Removal Effectiveness of powered and manual toothbrush in children: A Pilot Study. *Cumhuriyet Dental Journal.* 2018;21(4): 327-334.
33. Aggarwal N, Gupta S, Grover R, et al. Plaque Removal Efficacy of Different Toothbrushes: A Comparative Study. *International Journal of Clinical Pediatric Dentistry.* 2019;12(5):385-390. doi: 10.5005/jp-journals-10005-1669.

34. Silva AM, Miranda LFB, AraÚjo ASM, et al. Electric toothbrush for biofilm control in individuals with Down syndrome: a crossover randomized clinical trial. *Brazilian Oral Research.* 2020;34:e057. doi: 10.1590/1807-3107bor-2020.vol34.0057.
35. Davidovich, E, Ccahuana-Vasquez, RA, Timm, H, et al. Randomised clinical study of plaque removal efficacy of an electric toothbrush in primary and mixed dentition. *International Journal of Paediatric Dentistry*. 2021;31(5):657-663. doi: 10.1111/ipd.12753.
36. Elizondo ML, Rosa GM, Antola LDS, et al. Manual Versus Electric Toothbrush Efficacy in the Primary Dentition: A Randomized Crossover Clinical Trial Using Image Analysis of Digital Photographs. *Journal of Dentistry for Children.* 2023;90(1):31-38.
37. Graves A, Grahl T, Keiserman M, et al. Systematic Review and Meta Analysis of the Relative Effect on Plaque Index among Pediatric Patients Using Powered (Electric) versus Manual Toothbrushes. *Dentistry Journal (Basel).* 2023;11(2):46. doi: 10.3390/dj11020046.
38. Thomassen TMJA, Van der Weijden FGA, Slot DE. The efficacy of powered toothbrushes: A systematic review and network meta-analysis. *International Journal of Dental Hygiene.* 2022;20(1):3-17. doi: 10.1111/idh.12563.
39. Grender J, Goyal CR, Qaqish J, et al. A 12-Week Randomized Controlled Trial Comparing a Novel Electric Toothbrush With an Extra Gentle Brush Head to a Manual Toothbrush for Plaque and Gingivitis Reduction. *Compendium of Continuing Education in Dentistry.* 2022;43(3):f20-f29. (a)
40. Grender J, Goyal CR, Qaqish J, et al. Gingival health effects with an oscillating-rotating electric toothbrush with micro-vibrations and a novel brush head designed for stain control: Results from a 12-week randomized controlled trial. *American Journal of Dentistry.* 2022;35(5):219-226. (b)

Bölüm 15

MAKSİLLER SÜT KANİN DİŞİNİN ERKEN ÇEKİLMESİ MAKSİLLER DAİMİ KANİN DİŞİN GÖMÜLÜ KALMASINI ENGELLER Mİ ?

İsmail Haktan ÇELİK[1]
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GİRİŞ

Gömülü maksiller daimi kanin dişin ortodontik tedavisi günümüz klinisyenleri için zor olmaya devam etmektedir. Bu klinik durumun tedavisi genellikle gömülü dişin cerrahi olarak üzerinin açılması, ardından dental ark içine yönlendirilmesi ve hizalamak için ortodontik hareketi içerir. Maksiller kanin dişlerinin uygun şekilde konumlandırılması ve hizalanması, özellikle kanin rehberliği veya grup fonksiyonlu oklüzyon için kabul edilebilir yüz konturu, estetik gülümseme hattı ve oklüzyon oluşturulmasında son derece önemlidir.

Gömülü dişler genellikle çocuk diş hekimleri, ortodontistler veya genel diş hekimleri tarafından rutin diş muayenesi sırasında teşhis edilirler. Erken teşhis ve müdahale, daimi dişlenme dönemindeki uzun ve karmaşık tedavilerden kurtulmamızı sağlayabilir. Bu durumu başarılı bir şekilde yönetmek için farklı disiplinlerden uzmanların (ortodontistler, çocuk diş hekimleri, periodontologlar, ağız ve diş çene cerrahları ve genel diş hekimleri) multidisipliner yaklaşımı gereklidir.

1. GÖMÜLÜ KANİN DİŞ PREVELANSI VE ETİYOLOJİSİ

Üçüncü molar dişlerden sonra gömülü kalma potansiyeli en fazla olan dişler maksiller kanin dişler olmasına rağmen gömülü kalma prevalansları oldukça düşüktür (1). Bu prevelans etnik guruplar arasında farklılık göstermektedir. Literatürde çeşitli prevelans yüzdeleri görülmektedir. Literatürdeki en düşük prevelans %0.27 ile Japonya'da yapılan bir araştırmada rapor edilmiştir (3).

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SONUÇ

Erken karma dişlenme döneminde daimi kanin dişin gömülü kalması ile ilişkili olan diş bozukluklarının tanınması, bu durumun erken teşhisinde klinisyenlere yardımcı olabilir. Kaninlerin yer değiştirmesi erken tespit edilirse, klinisyenler olası bir gömülü kalma durumunu önleme yollarına odaklanmalıdır. Tüm bu değerlendirmeler yapılırken gömülü kanin dişin pozisyonunu akılda tutulması çok önemlidir. Ortodontik tedavi seçeneğine rağmen gömülü kanin dişlere sahip hastalar zorlu vakalardır. Bazen doğru teşhis ve tedavi planlamasına rağmen komplikasyon gelişerek diş kaybedilebileceği unutulmamalıdır.

KAYNAKÇA

1. Bishara SE, Kommer DD, McNeil MH et al. Management of impacted canines. *American Journal of Orthodontics.* 1976;69(4): 371-387. doi:10.1016/00029416(76)90207-4
2. Bishara SE. Impacted maxillary canines: A review. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1992;101(2): 159-171. doi: 10.1016/0889-5406(92)70008-X
3. Takahama Y, Aiyama Y. Maxillary canine impaction as a possible microform of cleft lip and palate. *European Journal of Orthodontics.* 1982;4(4): 275-277. doi: 10.1093/EJO/4.4.275
4. Thilander H, Thilander B, Persson G. Treatment of impacted teeth by surgical exposure. A survey study. *Svensk Tandlakare Tidskrift. Swedish Dental Journal.* 1973;66(6): 519–525.
5. Ericson S, Kurol J. Radiographic assessment of maxillary canine eruption in children with clinical signs of eruption disturbance. *European Journal of Orthodontics.* 1986;8(3): 133-140. doi: 10.1093/EJO/8.3.133
6. Topkara A, Sari Z. Impacted teeth in a turkish orthodontic patient population: prevalence, distribution and relationship with dental arch characteristics. *European Journal of Paediatric Dentistry.* 2012;13(4): 311-316
7. Aktan AM, Kara S, Akgünlü F et al. The incidence of canine transmigration and tooth impaction in a Turkish subpopulation. *European Journal of Orthodontics.2010;* 32(5): 575–581. doi: 10.1093/EJO/CJP151
8. Fournier A, Turcotte JY, Bernard C. Orthodontic considerations in the treatment of maxillary impacted canines. *American Journal of Orthodontics.* 1982;81(3): 236–239. doi: 10.1016/0002-9416(82)90056-2
9. Frank CA. Treatment options for impacted teeth. *The Journal of the American Dental Association*. 2000;31(5): 623–632. doi: 10.14219/JADA.ARCHIVE.2000.0236
10. Becker A, Smith P, Behar R. The incidence of anomalous maxillary lateral incisors in relation to palatally-displaced cuspids. *Angle Orthodontist*. 1981;51(1): 24-29. doi: 10.1043/0003-3219(1981)051<0024:tioaml>2.0.co;2
11. Payne M, Anderson JA, Cook J. Gardner's syndrome-A case report. *British Dental Journal Volüme.* 2002;193(7): 383. doi: 10.1038/sj.bdj.4801571
12. Bayar GR, Ortakolu K, Sencimen M. Multiple impacted teeth: Report of 3 Cases. *European Journal of Dentistry.* 2008;2(1): 73.

13. Jacoby H. The etiology of maxillary canine impactions. *American Journal of* Orthodontics. 1983;84(2): 125–132. doi: 10.1016/0002-9416(83)90176-8
14. Oliver RG, Mannion JE, Robinson JM. Morphology of the maxillary lateral incisor in cases of unilateral impaction of the maxillary canine. *British Journal of Orthodontics.* 1989;16(1): 9–16. doi: 10.1179/BJO.16.1.9
15. Alvesalo L, Portin p. The inheritance pattern of missing, peg-shaped, and strongly mesio-distally reduced upper lateral incisors. *Acta Odontologica Scandinavica.* 1969;27(6): 563–575. doi: 10.3109/00016356909026309
16. Chosack A, Eidelman E, Cohen T. Hypodontia: a polygenic trait--a family study among Israeli Jews. *Journal of Dental Research.* 1975;54(1): 16–19. doi: 10.1177/00220345750540011101
17. Arte S, Nieminen P, Apajalahti S et al. Characteristics of incisor-premolar hypodontia in families. *Journal of Dental Research*. 2001;80(5): 1445–1450, 2001. doi: 10.1177/00220345010800051201
18. Erpenstein H, Pfeiffer RA. Sex-linked-dominant hereditary reduction in number of teeth. *Humangenetik*. 1967;4(3): 280–293. doi: 10.1007/BF00292201
19. Thesleff I. The genetic basis of tooth development and dental defects. *American Journal of Medical Genetics. Part A*. 2006;140(23):2530–2535. doi: 10.1002/AJMG.A.31360
20. Pirinen S, Arte S, Apajalahti S. Palatal displacement of canine is genetic and related to congenital absence of teeth. *Journal of Dental Research*. 1996;75(10): 1742–1746. doi: 10.1177/00220345960750100601
21. Peck S, Peck L. Palatal displacement of canine is genetic and related to congenital absence of teeth. *Journal of Dental Research*. 1997;76(3): 728. doi: 10.1177/00220345970760030301
22. Peck S, Peck L, Kataja M. Concomitant occurrence of canine malposition and tooth agenesis: Evidence of orofacial genetic fields. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2002;122(6): 657–660. doi: 10.1067/MOD.2002.129915
23. Garib DG, Alencar BM, Lauris JRP et al. Agenesis of maxillary lateral incisors and associated dental anomalies. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2010;137(6): 732-733. doi: 10.1016/j.ajodo.2009.12.024
24. Sacerdoti R, Baccetti T. Dentoskeletal features associated with unilateral or bilateral palatal displacement of maxillary canines. *Angle Orthodontist.* 2004;74(6): 725–732. doi: 10.1043/0003-3219(2004)074<0725:dfawuo>2.0.co;2
25. Moss JP. The unerupted canine. *The Dental Practitioner and Dental Record*. 1972;226): 241–248.
26. Becker A. The median diastema. *Dental Clinics of North America.* 1978;22(4): 685–710. doi: 10.1016/S0011-8532(22)01246-0
27. Cayönü S, Yüksel BN, Sari S. Development of occlusion from the toothless period up to the permanent dentition. *Turkiye Klinikleri Journal of Dental Sciences.* 2020;26(1): 110-21. doi: 10.5336/dentalsci.2018-60529
28. Ericson S, Kurol J. Incisor resorption caused by maxillary cuspids a radiographic study. *Angle Orthodontist*. 1987;57(4): 332-346. doi:10.1043/0003 3219(1987)057<0332
29. Clark CA. A Method of ascertaining, the relative position of unerupted teeth by means of film radiographs. *Odontological Section*.1910;3: 87-90.
30. Keur JJ. Radiographic localization techniques. *Australian Dental Journal.* 1986;31(2): 86–90. doi: 10.1111/J.1834-7819.1986.TB02566.X

31. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. *American Journal of Orthodontics and Dentofacial Orthopedics.* 1987;91(6): 483–492. doi: 10.1016/0889-5406(87)90005-9
32. Tsolakis AI, Kalavritinos M, Sanoudos M. Reliability of different radiographic methods for the localization of displaced maxillary canines. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2018;153(2): 308–314 doi: 10.1016/J.AJODO.2017.06.026
33. Kau CH, Richmond S, Palomo JM et al. Three-dimensional cone beam computerized tomography in orthodontics. *Journal of Orthodontics.* 2005;32(4): 282–293. doi: 10.1179/146531205225021285
34. Shewinvanakitkul W, Hans MG, Narendran S et al. Measuring buccolingual inclination of mandibular canines and first molars using CBCT. *Orthodontics & Craniofacial Research.*2011;14(3): 68–174. doi: 10.1111/J.1601-6343.2011.01518.X
35. Hans MG, Palomo JM, Valiathan M. History of imaging in orthodontics from Broadbent to cone-beam computed tomography. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2015;148(6): 914–921. doi: 10.1016/J.AJODO.2015.09.007
36. Mah JK, Danforth RA, Bumann A et al. Radiation absorbed in maxillofacial imaging with a new dental computed tomography device. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics.* 2003;96(4): 508–513. doi: 10.1016/S1079-2104(03)00350-0
37. Garib DG, Calil LR, Leal CR et al. Is there a consensus for CBCT use in Orthodontics? *Dental Press Journal of Orthodontics.* 2014;19(5): 136–149. doi: 10.1590/2176-9451.19.5.136-149.SAR
38. Power SM, Short MB. An investigation into the response of palatally displaced canines to the removal of deciduous canines and an assessment of factors contributing to favourable eruption. *British Journal of Orthodontics.* 1993;20(3): 215–223. doi: 10.1179/BJO.20.3.215
39. Bazargani F, Magnuson A, Lennartsson B. Effect of interceptive extraction of deciduous canine on palatally displaced maxillary canine: a prospective randomized controlled study. *Angle Orthodontist.* 2014;84(1): 3–10. doi: 10.2319/031013-205.1
40. Naoumova J, Kurol J, Kjellberg H. Extraction of the deciduous canine as an interceptive treatment in children with palatal displaced canines - part I: shall we extract the deciduous canine or not? *European Journal of Orthodontics.* 2015;37(2): 209–218. doi: 10.1093/EJO/CJU040
41. Naoumova J, Kjellberg H. The use of panoramic radiographs to decide when interceptive extraction is beneficial in children with palatally displaced canines based on a randomized clinical trial. *European Journal of Orthodontics.* 2018;40(6): 565–574. doi: 10.1093/EJO/CJY002
42. Ericson S, Kurol J. Early treatment of palatally erupting maxillary canines by extraction of the primary canines. *European Journal of Orthodontics.* 1988;10(4): 283–295. doi: 10.1093/EJO/10.4.283
43. Leonardi M, Armi P, Franchi L et al. Two interceptive approaches to palatally displaced canines: A prospective longitudinal study. *Angle Orthodontist*. 2004;74(5): 581-586.
44. Baccetti T, Leonardi M, Armi P. A randomized clinical study of two interceptive approaches to palatally displaced canines. *European Journal of Orthodontics.* 2008;30(4): 381–385. doi: 10.1093/EJO/CJN023

45. Counihan K, Al-Awadhi EA, Butler J. Guidelines for the assessment of the impacted maxillary canine. *Dental Update.* 2013;40(9): 770–777. doi: 10.12968/DENU.2013.40.9.770
46. Stivaros N, Mandall NA. Radiographic factors affecting the management of ımpacted upper permanent canines. *Journal of Orthodontics.* 2000;27(2): 169-173. doi: 10.1093/ORTHO.27.2.169
47. McSherry PF. The assessment of and treatment options for the buried maxillary canine. *Dental Update.* 1996;23(1): 7–10. doi: 10.1093/ortho/27.2.169
48. Pitt S, Hamdan A, Rock P. A treatment difficulty index for unerupted maxillary canines. *European Journal of Orthodontics.* 2006;28(2): 141–144. doi: 10.1093/EJO/CJI068

Bölüm 16

ÇOCUK DİŞ HEKİMLİĞİNDE MTA KULLANIMI

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1. GİRİŞ

Çocuk diş hekimliğinde uygulanan tedavilerde başarılı sonuçlar elde etmek için doğru endikasyon ve teknikle beraber biyouyumlu, sızdırmazlık özelliği yüksek, toksik olmayan malzemeler kullanmak gereklidir. Kullanılan restoratif materyaller, vital dokularla temasta olacağından biyouyumlu olmasının yanında dokularda rejenerasyonu tetiklemeli ve mikroorganizma geçişini önlemelidir (1). Bugüne kadar, kök/kanal sistemi-oral kavite ve kök/kanal sistemi periradiküler dokular arasında, diş pulpasında herhangi bir nedenle oluşan açılmalar mikroorganizma geçiş yollarını kapatmak amacı ile birçok restoratif materyal kullanılmıştır. Bunlardan bazıları amalgam, ZnOE esaslı simanlar (IRM, Süper-EBA vb), kompozit rezinler ve cam iyonomer simanlardır. Fakat bu materyallerin, toksisiteye sahip olmaları, neme karşı hassas olmaları ve mikroorganizma geçişini yeteri kadar engelleyememeleri gibi dezavantajları vardır. Bu amaçla son yıllarda, kök-kanal sistemi ve dişin dış yüzeyleri arasında bağlantı yollarını kapatmak amacı ile geliştirilen ve klinik uygulamalarda başarılı sonuçlar verdiği rapor edilen Mineral Trioksit Agregat (MTA) kullanılmaya başlanmıştır (2).

Mineral trioksit agregat (MTA) bu özellikleriyle çocuk diş hekimliğinde vital pulpa tedavileri, apeksifikasyon, rejeneratif pulpa tedavisi uygulamaları, persiste süt dişlerinin kanal dolumu amacıyla kullanılan geleneksel endodontik materyallere üstün bir alternatif haline gelmiştir (1).

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renk değiştirir. Portland simanı renk değiştirme potansiyelinin, özellikle kana maruz kaldıklarında malzemelerin gözenekliliğinden kaynaklandığı bildirilmiştir (114).

İrrigant türünün de bizmut oksit içeren simanların renk bozulmasına sebep olduğu varsayılmaktadır (112). İrrigasyonun ardından diş renginde ProRoot MTA yerleştirildiğinde dentin tübüllerinde kalan NaOCl renk değişikliğine neden olabileceği bildirilmiştir (113).

6. SONUÇ

Başlangıçta kök ucu dolgu maddesi olarak geliştirilen MTA günümüzde diş hekimliğinde kullanım alanı yaygınlaşmıştır. Dokularda rejenerasyonu sağlaması, mikroorganizma geçişini yeteri kadar önleyebilmesi, biyo-uyumluluğu yüksek ve çocuklarda güvenle kullanılabilmesi Çocuk Diş Hekimleri için önemlidir. Yapılan çok sayıdaki in-vivo, in-vitro ve hayvan çalışmaların sonuçlarına göre Çocuk Diş Hekimliği alanında uygulanan birçok tedavide MTA'nın güvenle ve başarıyla kullanılmasının ve rutin klinik kullanımını desteklemiştir (2).

MTA'nın bu avantajlarının yanında dişte renklenmeye sebep olabilmesi, klinik kullanımının teknik hassasiyet gerektirmesi, uzun sertleşme zamanı, yüksek maliyeti, materyal için bilinen bir çözücünün olmaması ve iyileşme sonrası ortamdan uzaklaştırılmasının zor olması gibi var olan dezavantajlarını yok etmek amacıyla daha büyük örneklem büyüklüklerine sahip, uzun dönem takipli çalışmaların yapılması gerekmektedir (115).

KAYNAKÇA

1. Akyüz S., Kaya M.S., Demirel S. Çocuk Diş Hekimliğinde MTA: Bir Literatür Güncellemesi. *Türkiye Klinikleri Journal Dental Sci-Special Topics*. 2012;3(1):6-12.
2. Karayılmaz, H., & Kırzıoğlu, Z. Mineral Trioksit Agregat ve Pedodontideki Önemi. *Süleyman Demirel Üniversitesi Diş Hekimliği Fakültesi Dergisi*. 2011; 3(1).
3. Baltacıoğlu, E., Dikmen, R. D., & Yıldız, E. A. B. Direkt Pulpa Kaplaması Tedavilerinde Kullanılan Kalsiyum Hidroksit, Mineral Trioksit Agregat ve Biodentine'e Güncel Bir Bakış. *Bingöl Üniversitesi Sağlık Dergisi*. 2022; 3(1), 127-135..
4. Mody, A., Arora, R., Chauhan, P., et. al. A Scanning Electron Microscopic Study on Effect of Blood and Artificial Salivary Contamination on Marginal Adaptation of Mineral Trioxide Aggregate, When Used as a Retrograde Filling Material: An In Vitro Study. *International Journal of Clinical Pediatric Dentistry*. 2021,14(5), 674.
5. Tawil PZ, Duggan DJ, Galicia JC. Mineral trioxide aggregate (MTA): its history, composition, and clinical applications. *Compendium of Continuing Education in Dentistry (Jamesburg, N.J.: 1995),* 2015;36(4):247-264.

6. Quintana, R. M., Jardine, A. P., Grechi, et al. Bone tissue reaction, setting time, solubility, and pH of root repair materials. *Clinical Oral İnvestigations,* 2019, 23(3), 1359–1366. https://doi.org/10.1007/s00784-018-2564-1.
7. Mondelli JAS, Hoshino RA, Weckwerth PH, et al. Biocompatibility of mineral trioxide aggregate flow and biodentine. *International Endodontic Journal*, 2019;52(2):193-200. doi:10.1111/iej.12989.
8. Pelepenko LE, Saavedra F, Bombarda GF, et al. Dental discoloration caused by Grey-MTAFlow cement: analysis of its physicochemical, biological and antimicrobial properties. *Journal of Applied Oral Science.* 2020;28:e20200269. doi:10.1590/1678-7757-2020-0269.
9. Camilleri J. Staining Potential of Neo MTA Plus, MTA Plus, and Biodentine Used for Pulpotomy Procedures. *Journal of Endodontics.* 2015; 41(7),1139–1145. https://doi.org/10.1016/j.joen.2015.02.032.
10. Torabinejad M, Hong CU, McDonald F, Pitt Ford TR. Physical and chemical properties of a new root-end filling material. J Endod. 1995;21(7):349-353. doi:10.1016/S0099-2399(06)80967-2.
11. Parirokh, Masoud, And Mahmoud Torabinejad. Mineral Trioxide Aggregate: A Comprehensive Literature Review-Part I: Chemical, Physical, and Antibacterial Properties. *Journal of Endodontics*. 2010; 36 (1): 16–27.
12. Kamalı, Alemete Suriyanarayanan, et al. An Overview Of The Role Of Mineral Trioxide Aggregate In Endodontics. *Journal of Applied Oral Science*. 2021; 12.3: 2089-2094.
13. Saghiri MA, Gutmann JL, Orangi J, Asatourian A, Sheibani N. Radiopacifier particle size impacts the physical properties of tricalcium silicate-based cements. *Journal of Endodontics*. 2015;41(2):225-230. doi:10.1016/j.joen.2014.09.025.
14. Meshack, Rufus Allwyn, et al. Overview of root end filling materials. *International Journal of Clinical Dental Science.* 2012; 3.1.
15. Kayahan MB, Nekoofar MH, Kazandağ M, et al. Effect of acid-etching procedure on selected physical properties of mineral trioxide aggregate. *International Endodontic Journal*. 2009;42(11):1004-1014. doi:10.1111/j.1365-2591.2009.01610.
16. Elnaghy AM. Influence of acidic environment on properties of biodentine and white mineral trioxide aggregate: a comparative study. *Journal of Endodontics*. 2014; 40(7):953-957. doi:10.1016/j.joen.2013.11.007.
17. Wang Z, Ma J, Shen Y, Haapasalo M. Acidic pH weakens the microhardness and microstructure of three tricalcium silicate materials. *International Endodontic Journal*. 2015;48(4):323-332. doi:10.1111/iej.12318.
18. Asgary S, Shirvani A, Fazlyab M. MTA and ferric sulfate in pulpotomy outcomes of primary molars: a systematic review and meta-analysis. *The Journal of Clinical Pediatric Dentistry*. 2014;39(1):1-8. doi:10.17796/jcpd.39.1.b454r616m2582373.
19. Deepthi V, Mallikarjun E, Nagesh B, Mandava P. Effect of acidic pH on microhardness and microstructure of TheraCal LC, endosequence, mineral trioxide aggregate, and biodentine when used as root repair material. *Journal of Conservative Dentistry.* 2018;21(4):408-412. doi:10.4103/JCD.JCD_308_17.
20. Sobhnamayan F, Adl A, Shojaee NS, Gavahian S. The effect of chlorhexidine on the push-out bond strength of calcium-enriched mixture cement. *Iranian Endodontic Journal*. 2015;10(1):59-63.

21. Gul, P., Çaglayan, F., Akgul, N., & Akgul, H. M. Comparison of radiopacity of different composite resins. *Journal of Conservative Dentistry.* 2017; 20.1: 17.
22. Marciano MA, Camilleri J, Lucateli RL. et. al. Physical, chemical, and biological properties of white MTA with additions of AlF_3. *Clinical Oral İnvestigations*. 2019;23(1):33-41. doi:10.1007/s00784-018-2383-4.
23. Pelepenko LE, Saavedra F, Bombarda GF, et al. Dental discoloration caused by Grey-MTAFlow cement: analysis of its physicochemical, biological and antimicrobial properties. *Journal of applied oral science*, 2020;28:e20200269. doi:10.1590/1678-7757-2020-0269.
24. Siboni F, Taddei P, Prati C, Gandolfi MG. Properties of NeoMTA Plus and MTA Plus cements for endodontics. *Int Endod J*. 2017;50 Suppl 2:e83-e94. doi:10.1111/iej.12787.
25. Cavenago BC, Pereira TC, Duarte MA, et al. Influence of powder-to-water ratio on radiopacity, setting time, pH, calcium ion release and a micro-CT volumetric solubility of white mineral trioxide aggregate. *International Endodontic Journal*. 2014;47(2):120-126. doi:10.1111/iej.12120.
26. Akçay H, Arslan H, Akçay M. et al. Kan kontaminasyonu yokluğunda/varlığında kök ucuna yerleştirilmiş mineral trioksit agrega ve biodentinin bağlanma gücünün değerlendirilmesi. *Avrupa Diş Hekimliği Dergisi*. 2016:10 (3):370–75.
27. Salem Milani A, Rahimi S, Froughreyhani M, et al. Effect of Blood Contamination on Marginal Adaptation and Surface Microstructure of Mineral Trioxide Aggregate: A SEM Study. *Journal Of Dental Research, Dental Clinics, Dental Prospects*, 2013;7(3):157-163. doi:10.5681/joddd.2013.025.
28. Nekoofar, M. H., Oloomi, K., Sheykhrezae, M. S., et al. An evaluation of the effect of blood and human serum on the surface microhardness and surface microstructure of mineral trioxide aggregate. *International Endodontic Journal*. 2010;43(10):849–858. https://doi.org/10.1111/j.1365-2591.2010.01750.
29. Pelepenko LE, Saavedra F, Antunes TBM, et al. Physicochemical, antimicrobial, and biological properties of White-MTAFlow. *Clinical Oral İnvestigations*. 2021;25(2):663-672. doi:10.1007/s00784-020-03543-7.
30. Nikhil V, Jha P, Suri NK. Effect of methods of evaluation on sealing ability of mineral trioxide aggregate apical plug. *Journal Of Conservative Dentistry*. 2016;19(3):231-234. doi:10.4103/0972-0707.181938.
31. Parirokh, M., Torabinejad, M., & Dummer, P. Mineral trioxide aggregate and other bioactive endodontic cements: an updated overview- part I: vital pulp therapy. *International Endodontic Journal.* 2018; 51(2): 177–205. https://doi.org/10.1111/iej.12841.
32. Lim M, Yoo S. The antibacterial activity of mineral trioxide aggregate containing calcium fluoride. *Journal of Dental Sciences*. 2022;17(2):836-841. doi:10.1016/j.jds.2021.09.005.
33. Laurent, P., Camps, J., & About, I. Biodentine (TM) induces TGF-β1 release from human pulp cells and early dental pulp mineralization. *International Endodontic Journal.* 2012; 45(5): 439–448. https://doi.org/10.1111/j.1365-2591.2011.01995.
34. Kunert M, Lukomska-Szymanska M. Bio-Inductive Materials in Direct and Indirect Pulp Capping-A Review Article. Materials (Basel). 2020;13(5):1204. Published 2020 Mar 7. doi:10.3390/ma13051204.
35. Rodrigues EM, Cornélio ALG, Mestieri LB, et al. Human dental pulp cells response to mineral trioxide aggregate (MTA) and MTA Plus: cytotoxicity and gene expression analysis, *International Endodontic Journal*. 2017;50(8):780-789. doi:10.1111/iej.12683.

36. Ratih, D. N., & Putri, A. R. Effect of blood contamination on push-out bond strength of mineral trioxide aggregate mixed with different liquids. *Journal of Medical and Biological Engineering*. 2017; 37(2): 262-267.
37. Rouhani, A., Azimi, N., Akbari, M., Ahmadpour, A. et al. Effect of adding nano size silica on setting time and porosity of mineral trioxide aggregate. *Iranian Endodontic Journal*. 2019; 14(3): 197-201.
38. Frisk F, Kvist T, Axelsson S, et al. Pulp exposures in adults--choice of treatment among Swedish dentists. *Swedish Dental Journal*. 2013;37(3):153-160.
39. Krastl G, Weiger R, Filippi A, et al. Endodontic management of traumatized permanent teeth: a comprehensive review. *International Endodontic Journal*. 2021;54(8):1221-1245. doi:10.1111/iej.13508.
40. Mohammadi Z, Dummer PM. Properties and applications of calcium hydroxide in endodontics and dental traumatology. *International Endodontic Journal*. 2011;44(8):697-730. doi:10.1111/j.1365-2591.2011.01886.
41. Akhlaghi N, Khademi A. Outcomes of vital pulp therapy in permanent teeth with different medicaments based on review of the literature. *Dental Research Journal (Isfahan)*. 2015;12(5):406-417. doi:10.4103/1735-3327.166187.
42. Lee LW, Hsiao SH, Hung WC, Lin YH, Chen PY, Chiang CP. Clinical outcomes for teeth treated with electrospun poly(ε-caprolactone) fiber meshes/mineral trioxide aggregate direct pulp capping. *Journal of Endodontics*. 2015;41(5):628-636. doi:10.1016/j.joen.2015.01.007.
43. Dammaschke T, Nowicka A, Lipski M, et al. Histological evaluation of hard tissue formation after direct pulp capping with a fast-setting mineral trioxide aggregate (RetroMTA) in humans. *Clinical Oral İnvestigations*. 2019;23(12):4289-4299. doi:10.1007/s00784-019-02876-2.
44. Abuelniel GM, Duggal MS, Duggal S, Kabel NR. Evaluation of Mineral Trioxide Aggregate and Biodentine as pulpotomy agents in immature first permanent molars with carious pulp exposure: A randomised clinical trial. *European Journal of Paediatric Dentistry*. 2021;22(1):19-25. doi:10.23804/ejpd.2021.22.01.04.
45. Bossù M, Iaculli F, Di Giorgio G, et al. Different Pulp Dressing Materials for the Pulpotomy of Primary Teeth: A Systematic Review of the Literature. *Journal of Clinical Medicine*. 2020;9(3):838. Published 2020 Mar 19. doi:10.3390/jcm9030838.
46. Simancas-Pallares MA, Díaz-Caballero AJ, Luna-Ricardo LM. Mineral trioxide aggregate in primary teeth pulpotomy. A systematic literature review. *Medicina Oral Patologia Oral Cirugia Bucal*, 2010;15(6):e942-e946. Published 2010 Nov 1. doi:10.4317/medoral.15.e942.
47. Anthonappa RP, King NM, Martens LC. Is there sufficient evidence to support the long-term efficacy of mineral trioxide aggregate (MTA) for endodontic therapy in primary teeth?. *International Endodontic Journal*. 2013;46(3):198-204. doi:10.1111/j.1365-2591.2012.02128.
48. Lin PY, Chen HS, Wang YH, Tu YK. Primary molar pulpotomy: a systematic review and network meta-analysis. *Journal of dentistry*. 2014;42(9):1060-1077. doi:10.1016/j.jdent.2014.02.001.
49. Marghalani AA, Omar S, Chen JW. Clinical and radiographic success of mineral trioxide aggregate compared with formocresol as a pulpotomy treatment in primary molars: a systematic review and meta-analysis. *Journal of the American Dental Association*. 2014;145(7):714-721. doi:10.14219/jada.2014.36.

50. Stringhini Junior E, Dos Santos MGC, Oliveira LB, et al. MTA and biodentine for primary teeth pulpotomy: a systematic review and meta-analysis of clinical trials. *Clinical oral investigations*. 2019;23(4):1967-1976. doi:10.1007/s00784-018-2616-6.
51. Akcay M, Sari S. The effect of sodium hypochlorite application on the success of calcium hydroxide and mineral trioxide aggregate pulpotomies in primary teeth. *Pediatric dentistry*. 2014;36(4):316-321.
52. Galani M., Tewari S., Sangwan P., Mittal S., Kumar V., Duhan J. Comparative evaluation of postoperative pain and success rate after pulpotomy and root canal treatment in cariously exposed mature permanent molars: A randomized controlled trial. *Journal of endodontics,* 2017; 43:1953–1962. Doi: 10.1016/j.joen.2017.08.007.
53. Fuks, A. B., Peretz, B., & Teeth, Y. P. Pediatric Endodontics. *Current Concepts in Pulp Therapy for Primary and Young Permanent Teeth. Ed. Israiel: Editorial Springer*; 2016.
54. Savovic J, Turner RM, Mawdsley D, et al. Association Between Risk-of-Bias Assessments and Results of Randomized Trials in Cochrane Reviews: The ROBES Meta-Epidemiologic Study. *American journal of epidemiology*. 2018;187(5):1113-1122. doi:10.1093/aje/kwx344.
55. Taweewattanapaisan P, Jantarat J, Ounjai P, Janebodin K. The Effects of EDTA on Blood Clot in Regenerative Endodontic Procedures. *Journal of endodontics*. 2019;45(3):281-286. doi:10.1016/j.joen.2018.10.010.
56. Tuloglu, N.; Bayrak, S. Comparative evaluation of mineral trioxide agg,egate and bioaggregate as apical barrier material in traumatized nonvital, immature teeth: A clinical pilot study. *Nigerian Journal of Clinical Practice*. 2016;19.1: 52-57.
57. Annamalai S, Mungara J. Efficacy of mineral trioxide aggregate as an apical plug in non-vital young permanent teeth: preliminary results. *The Journal of clinical pediatric dentistry*. 2010;35(2):149-155. doi:10.17796/jcpd.35.2.9061h7g718834017.
58. Moore A, Howley MF, O'Connell AC. Treatment of open apex teeth using two types of white mineral trioxide aggregate after initial dressing with calcium hydroxide in children. *Dental traumatology : official publication of International Association for Dental Traumatology*. 2011;27(3):166-173. doi:10.1111/j.1600-9657.2011.00984.
59. Pace R, Giuliani V, Nieri M, et al. Mineral trioxide aggregate as apical plug in teeth with necrotic pulp and immature apices: a 10-year case series. *Journal of endodontics.* 2014;40(8):1250-1254. doi:10.1016/j.joen.2013.12.007.
60. Bonte E, Beslot A, Boukpessi T, Lasfargues JJ. MTA versus Ca(OH)2 in apexification of non-vital immature permanent teeth: a randomized clinical trial comparison. *Clinical oral investigations.* 2015;19(6):1381-1388. doi:10.1007/s00784-014-1348-5.
61. Bücher K, Meier F, Diegritz C, et al. Long-term outcome of MTA apexification in teeth with open apices. *Quintessence international.* 2016;47(6):473-482. doi:10.3290/j.qi.a35702.
62. Bogen G, Ricucci D. Mineral trioxide aggregate apexification: a 20-year case review. *Australian endodontic journal: the journal of the Australian Society of Endodontology Inc*. 2021;47(2):335-342. doi:10.1111/aej.12442.
63. Sogukpinar A, Arikan V. Comparative evaluation of four endodontic biomaterials and calcium hydroxide regarding their effect on fracture resistance of simulated immature teeth. *European journal of paediatric dentistry*. 2020;21(1):23-28. doi:10.23804/ejpd.2020.21.01.05.
64. Aşar, Enes Mustafa; Botsalı, Murat Selim. Rejeneratif Endodontik Tedavi: Bir Literatür Derlemesi. *Selcuk Dental Journal*. 2022: 9.1: 335-343.

65. Galler KM, Krastl G, Simon S, et al. European Society of Endodontology position statement: Revitalization procedures. *International Endodontic Journal*. 2016;49(8):717-723. doi:10.1111/iej.12629.
66. Kvinnsland SR, Bårdsen A, Fristad I. Apexogenesis after initial root canal treatment of an immature maxillary incisor- a case report. *International Endodontic Journal*. 2010;43(1):76-83. doi:10.1111/j.1365-2591.2009.01645.
67. Nagata JY, Rocha-Lima TF, Gomes BP, et al. Pulp revascularization for immature replanted teeth: a case report. *Australian Dental Journal*. 2015;60(3):416-420. doi:10.1111/adj.12342.
68. Ramezani M, Sanaei-Rad P, Hajihassani N. Revascularization and vital pulp therapy in immature molars with necrotic pulp and irreversible pulpitis: A case report with two-year follow-up. *Clinical case reports*. 2019;8(1):206-210. Published 2019 Dec 19. doi:10.1002/ccr3.2614.
69. Kontakiotis EG, Filippatos CG, Tzanetakis GN, et al. Regenerative endodontic therapy: a data analysis of clinical protocols. *Journal of Endodontics*. 2015;41(2):146-154. doi:10.1016/j.joen.2014.08.003.
70. Torabinejad M, Nosrat A, Verma P, Udochukwu O. Regenerative Endodontic Treatment or Mineral Trioxide Aggregate Apical Plug in Teeth with Necrotic Pulps and Open Apices: A Systematic Review and Meta-analysis. *Journal of endodontics*. 2017;43(11):1806-1820. doi:10.1016/j.joen.2017.06.029.
71. Ramezani M, Sanaei-Rad P, Hajihassani N. Revascularization and vital pulp therapy in immature molars with necrotic pulp and irreversible pulpitis: A case report with two-year follow-up. *Clinical case reports*. 2019;8(1):206-210. Published 2019 Dec 19. doi:10.1002/ccr3.2614.
72. Loroño G, Jesús Conde A, Estévez R, et. al. Regenerative endodontic procedure in an ımmature permanent ıncisor with ınternal root resorption: a case report. *Journal of dentistry.* 2022;23(2):155-160. Doi:10.30476/dentjods.2022.88349.1328.
73. Alobaid AS, Cortes LM, Lo J, et al. Radiographic and clinical outcomes of the treatment of immature permanent teeth by revascularization or apexification: a pilot retrospective cohort study. *Journal Of Endodontics*. 2014;40(8):1063-1070. doi:10.1016/j.joen.2014.02.016.
74. Karan, Nazife Begüm; Arıcıoğlu, Banu. Farklı Retrograd Dolgu Materyallerinin Apikal Dokular Üzerindeki İyileşmeye Etkisinin Retrospektif Olarak Değerlendirilmesi. *Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi*. 2019; 29.2: 252-258.
75. Post LK, Lima FG, Xavier CB, et al. Sealing ability of MTA and amalgam in different root-end preparations and resection bevel angles: an in vitro evaluation using marginal dye leakage. *Brazilian Dental Journal*. 2010;21(5):416-419. doi:10.1590/s0103-64402010000500007.
76. Badr AE. Marginal adaptation and cytotoxicity of bone cement compared with amalgam and mineral trioxide aggregate as root-end filling materials. *Journal of Endodontics*. 2010;36(6):1056-1060. doi:10.1016/j.joen.2010.02.018.
77. Ikhar A, Thakur N, Patel A, et al. Management of external invasive cervical resorption tooth with mineral trioxide aggregate: a case report. *Case Rep Med*. 2013;2013:139801. doi:10.1155/2013/139801.
78. Song M, Jung IY, Lee SJ, et al. Prognostic factors for clinical outcomes in endodontic microsurgery: a retrospective study. *Journal of Endodontics*. 2011;37(7):927-933. doi:10.1016/j.joen.2011.04.005.

79. Song W, Li S, Tang Q, et al. In vitro biocompatibility and bioactivity of calcium silicatebased bioceramics in endodontics (Review). *International journal of molecular medicine*. 2021;48(1):128. doi:10.3892/ijmm.2021.4961.
80. Kim S, Song M, Shin SJ, Kim E. A Randomized Controlled Study of Mineral Trioxide Aggregate and Super Ethoxybenzoic Acid as Root-end Filling Materials in Endodontic Microsurgery: Long-term Outcomes. *Journal of Endodontics*. 2016;42(7):997-1002. doi:10.1016/j.joen.2016.04.008.
81. Tuloglu N, Bayrak S. Comparative evaluation of mineral trioxide aggregate and bioaggregate as apical barrier material in traumatized nonvital, immature teeth: A clinical pilot study. *Nigerian journal of clinical practice*. 2016;19(1):52-57. doi:10.4103/1119-3077.164332.
82. Van Pham K, Tran TA. Effectiveness of MTA apical plug in dens evaginatus with open apices. *BMC Oral Health*. 2021;21(1):566. Published 2021 Nov 8. doi:10.1186/s12903-021-01920-6.
83. Yüzer, G. M., & Uysal, M. E. Endodontik Perforasyonlarda Kullanılan Tamir Materyalleri. *New Developments in Health and Life Sciences*, 2021.
84. Tetik, E. A. Ç., & Öztan, M. D. Perforasyon tedavisinde kullanılan çeşitli materyallerin sitotoksisitelerinin değerlendirilmesi. *European Annals of Dental Sciences*. 2017; *44*(3), 147-154.
85. da Silva, E. J., Andrade, C. V., Tay, L. Y. et.al. Furcal-perforation repair with mineral trioxide aggregate: Two years follow-up. *Indian journal of dental research: official publication of Indian Society for Dental Research*. 2012; 23(4), 542–545. https://doi.org/10.4103/0970-9290.104967.
86. Ha WN, Duckmanton P, Kahler B, et al. A survey of various endodontic procedures related to mineral trioxide aggregate usage by members of the Australian Society of Endodontology. *Australian endodontic journal : the journal of the Australian Society of Endodontology Inc.* 2016;42(3):132-138. doi:10.1111/aej.12170.
87. Aminov, L., Moscalu, M., Melian, A., et. al. Clinical-radiological study on the role of biostimulating materials in iatrogenic furcation lesions. *Revista medico-chirurgicala a Societatii de Medici si Naturalisti din Iasi.* 2012; 116(3), 907–913.
88. Haghgoo R, Niyakan M, Nazari Moghaddam K, et al. An In vitro Comparison of Furcal Perforation Repaired with Pro-root MTA and New Endodontic Cement in Primary Molar Teeth- A Microleakage Study. *Journal of dentistry (Shiraz, Iran)*. 2014;15(1):28-32.
89. Bayram, H. M., Saklar, F., Bayram, E., et al. Determination of the apical sealing abilities of mineral trioxide aggregate, portland cement, and bioaggregate after irrigation with different solutions. *Journal of international oral health: JIOH*, 2015;*7*(6), 13.
90. Övsay, E., Kaptan, R. F., & Şahin, F. The repair of furcal perforations in different diameters with Biodentine, MTA, and IRM repair materials: a laboratory study using an E. Faecalis leakage model. *BioMed research international*, 2018.
91. Özdemir O, Koçak, S. Sağlam, B, et al. Kök Rezorpsiyonları. *Uluslararası Diş Hekimliği Bilimleri Dergisi*, 2019; 5(2), 38-44.
92. Yıldırım D, Kamalı S. Öveçoğlu, H. S, et al. Eksternal Apikal Kök Rezorpsiyonunun Mineral Trioksit Agregat İle Tedavisi: İki Vaka Raporu. *European Journal of Research in Dentistry*, 2022, 6(1), 25-28.
93. Bolaca A, Güngör G. M. İnflamatuar Eksternal Kök Rezorpsiyonunun Mineral Trioksit Agregat ile Tedavisi. *Proceeding Book*. 2022.

94. Gök, T, Çapar, İ. D. İnternal kök rezorpsiyonunun MTA ile tedavisi: Olgu bildirimi. *Selcuk Dental Journal*. 2014; 1(2), 66-70.
95. Abdullah, D, Eziana Hussein, F, Abd Ghani, H. Management of Perforating Idiopathic Internal Root Resorption. *Iranian Endodontic Journal*. 2017; 12(2), 257–260. https://doi.org/10.22037/iej.2017.50.
96. Subay R. K, Subay, M. O, Tuzcu, S. B. Endodontic management of root perforating internal replacement resorption. *European Journal of Dentistry*, 2018; 12(03), 450-453.
97. Rao, A, Rao, A. ve Shenoy, R. Mineral trioxide aggregate--a review. Journal of Clinical Pediatric Dentistry. 2009; 34(1), 1-7.
98. Dogan S, Duruturk L, Orhan AI, Batmaz I. Determining treatibility of primary teeth with pulpal exposure. *Journal of Clinical Pediatric Dentistry*. 2013; 37, 345–5.
99. Chute, A. K. Toshniwal, A. Gade, V, et al. Repair of incomplete horizontal mid-root fracture of maxillary central incisor with mineral trioxide aggregate: A follow up report. *Journal of Conservative Dentistry*: JCD, 2014; 17(4), 393–395. https://doi.org/10.4103/0972-0707.136521.
100. Çiçek, E., Yılmaz, N., & Koçak, M. M. Intraradicular splinting with endodontic instrument of horizontal root fracture. *Case Reports in Dentistry*, *2015*.
101. Erdem, A. P., Ozdas, D. O., Dincol, E., et. al. Case Series: root healing with MTA after horizontal fracture. *European archives of paediatric dentistry: official journal of the European Academy of Paediatric Dentistry*. 2009;10(2):110–113. https://doi.org/10.1007/BF03321611
102. Parekh, D. J., Sathyanarayanan, R., & Manjunath, M. T. Clinical management of mid-root fracture in maxillary central incisors: case reports. *International journal of oral science*. 2010; 2(4):215–221.
doi.org/10.4248/IJOS10067.
103. Roig M, Espona J, Mercadé M, Duran-Sindreu F. Horizontal root fracture treated with MTA, a case report with a 10-year follow-up. *Dental traumatology: official publication of International Association for Dental Traumatology*. 2011;27(6):460-463. doi:10.1111/j.1600-9657.2011.01018.
104. Choi Y, Hong SO, Lee SR, Min KS, Park SJ. Healing after horizontal root fractures: 3 cases with 2-year follow-up. *Restorative dentistry & endodontics*, 2014;39(2):126-131. doi:10.5395/rde.2014.39.2.126.
105. Angulus Science and Technology MTA-Fillapex Endodontic Sealer, Scientific Profile. 2011. [(accessed on 22 August 2021)]. Available online: http://www.angelusdental.com/img/arquivos/mta_fillapex_technical_profile_download.pdf.
106. Doğan, Ö, Gökçe Meydan, E, Altıntepe Doğan, S, et al. Root canal filling with neomta plus in second primary molar teeth with missing successor: twenty-four months of follow-up. *Cumhuriyet Dental Journal*. 2021;24(4):2146-2852. doi:10.7126/cumudj.936226 2021.
107. Hutcheson C, Seale NS, McWhorter A, et al. Multi-surface composite vs stainless steel crown restorations after mineral trioxide aggregate pulpotomy: a randomized controlled trial. *Pediatric Dentistry*. 2012;34(7):460-467.
108. Krastl, G., Allgayer, N., Lenherr, P., et al. Tooth discoloration induced by endodontic materials: a literature review. *Dental traumatology: official publication of International Association for Dental Traumatology*, 2013; 29 (1): 2-7. doi:10.1111/j.1600-9657.2012.01141.

109. Ioannidis K, Mistakidis I, Beltes P, Karagiannis V. Spectrophotometric analysis of coronal discolouration induced by grey and white MTA. *International Endodontic Journal.* 2013;46(2):137-144. doi:10.1111/j.1365-2591.2012.02098.
110. Vallés M, Mercadé M, Duran-Sindreu F, et al. Influence of light and oxygen on the color stability of five calcium silicate-based materials. *Journal of endodontics.* 2013;39(4):525-528. doi:10.1016/j.joen.2012.12.021.
111. Berger T, Baratz AZ, Gutmann JL. In vitro investigations into the etiology of mineral trioxide tooth staining. *Journal of Conservative Dentistry*. 2014;17(6):526-530. doi:10.4103/0972-0707.144584.
112. Marciano, M. A., Costa, R. M., Camilleri, J., Mondelli, et al. Assessment of color stability of white mineral trioxide aggregate angelus and bismuth oxide in contact with tooth structure. *Journal of endodontics*. 2014;40(8):1235-40. doi:10.1016/j.joen.2014.01.044.
113. Oliveira, I. R., Pandolfelli, V. C., Jacobovitz, M.. Chemical, physical and mechanical properties of a novel calcium aluminate endodontic cement. *International Endodontic Journal*. 2010; 43(12): 1069-76. doi:10.1111/j.1365-2591.2010.01770.
114. Garcia, L.daF., Aguilar, F. G., Rossetto, H. L., et. al. Staining susceptibility of new calcium aluminate cement (EndoBinder) in teeth: a 1-year in vitro study. *Dental traumatology: official publication of International Association for Dental Traumatology*, 2013;*29*(5), 383–388. https://doi.org/10.1111/edt.12011.
115. Lenherr, P., Allgayer, N., Weiger, R., et. al. Tooth discoloration induced by endodontic materials: a laboratory study. *International Endodontic Journal*. 2012; 45(10), 942–949. https://doi.org/10.1111/j.1365-2591.2012.02053.x.
116. Felman D, Parashos P. Coronal tooth discoloration and white mineral trioxide aggregate. *Journal of Endodontics*. 2013;39(4):484-487. doi:10.1016/j.joen.2012.11.053.
117. İnci, M. A., Hazal, Ö. Z. E. R., & Keskin, Ü. Mineral Trioksit Agregat: Bir Literatür Derlemesi. *Selcuk Dental Journal*. 2022, 9(3), 986-994.

Bölüm 17

PEDİATRİK KANSER TEDAVİSİ SÜRECİNDE AĞIZ VE DİŞ SAĞLIĞI YÖNETİMİ

Müge BULUT[1]

GİRİŞ

Kanser, vücudun çoğu organ veya dokusunda ortaya çıkabilen, değişime uğramış anormal hücrelerin kontrolsüz bir şekilde büyüyerek çevre dokuları istila etmesi ve bazen diğer organlara yayılması sonucu beliren, tedavi yaklaşımı ve klinik özellikleri çeşitlilik gösteren bir hastalık türüdür (1,2).

Pediatrik kanserler, farklı oluşum kalıpları (3), nedenleri (4), tedavi yöntemleri, destekleyici bakım gereksinimleri, hayatta kalma oranları (5) ve akut toksik yan etki ile uzun dönemde ortaya çıkabilen yan etki riskleri gibi farklı özelliklere sahip heterojen bir maligniteler grubudur (6,7). Pediatrik kanserlerin en yaygın türleri arasında lösemiler, beyin kanserleri, lenfomalar ve nöroblastoma ve Wilms tümörleri gibi tümörler bulunur (8,9).

Gelişmiş ülkelerde kapsamlı hizmetlere genellikle erişim sağlanabildiği için kanser teşhisi konulan çocukların %80' den fazlası iyileşebilmekteyken, düşük ve orta gelirli ülkelerde bu oran %30' un altında kalmaktadır (9,10). Düşük ve orta gelirli ülkelerde, pediatrik kanserlerden kaynaklanan ölümler genellikle teşhis eksikliği, hatalı veya geç teşhis, sağlık hizmetlerine erişim engelleri, tedaviyi terk etme, tedaviye bağlı toksisite sonucu ölümler ve nüks gibi faktörlerden kaynaklanmaktadır. Düşük gelirli ülkelerin yalnızca %29' u kanser ilaçlarına erişebildiklerini bildirirken, bu oran yüksek gelirli ülkelerde %96' ya yükselmektedir (9,10). Genel olarak pediatrik kanser önlenememekte veya tarama yoluyla tespit edilememektedir (11). Kanser tedavisindeki yöntemler arasında cerrahi operasyonlar, kemoterapi, radyasyon tedavisi, immünoterapi ve kök hücre nakli yer almaktadır. Tedavi uygulanacak çocukların büyük bir bölümünde, kemoterapi veya bu tedavi yöntemlerinin bir kombinasyonu uygulanmaktadır (12). Kemoterapi, hızla bölünen hücrelere etki eden, sentetik veya doğal, biyolojik veya

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KAYNAKÇA

1. Costa, J. Cancer. Encyclopedia Britannica. https://www.britannica.com/science/cancer-disease (Erişim tarihi 13.08.23)
2. World Health Organization. Cancer. https://www.who.int/health-topics/cancer#tab=tab_1 (Erişim tarihi 13.08.23)
3. Steliarova-Foucher E, Colombet M, Ries L, et al., International Incidence of Childhood Cancer, Volume III (electronic version) Lyon, Available from:, International Agency for Research on Cancer, France, 2017. http://iicc.iarc.fr/results/.
4. Spector LG, Pankratz N, Marcotte EL. Genetic and nongenetic risk factors for childhood cancer. *Pediatr Clin North Am.* 2015;62(1):11-25. doi: 10.1016/j.pcl.2014.09.013.
5. Gatta G, Botta L, Rossi S, et al. Childhood cancer survival in Europe 1999-2007: results of EUROCARE-5--a population-based study. *Lancet Oncol.* 2014;15(1):35-47. doi: 10.1016/S1470-2045(13)70548-5.
6. Landier W, Armenian S, Bhatia S. Late effects of childhood cancer and its treatment. *Pediatr Clin North Am.* 2015;62(1):275-300. doi: 10.1016/j.pcl.2014.09.017.
7. Fidler MM, Reulen RC, Winter DL, et al. British Childhood Cancer Survivor Study Steering Group. Long term cause specific mortality among 34 489 five year survivors of childhood cancer in Great Britain: population based cohort study. *BMJ.* 2016;354:i4351. doi: 10.1136/bmj.i4351.
8. Steliarova-Foucher E, Colombet M, Ries LAG, et al. IICC-3 contributors. International incidence of childhood cancer, 2001-10: a population-based registry study. *Lancet Oncol.* 2017;18(6):719-731. doi: 10.1016/S1470-2045(17)30186-9.
9. World Health Organization. (‍ 2021)‍ . CureAll framework: WHO global initiative for childhood cancer: increasing access, advancing quality, saving lives. World Health Organization.https://apps.who.int/iris/handle/10665/347370
10. Lam CG, Howard SC, Bouffet E, Pritchard-Jones K. Science and health for all children with cancer. *Science.* 2019;363(6432):1182-1186. doi: 10.1126/science.aaw4892.
11. Childhood cancer, key facts. https://www.who.int/news-room/fact-sheets/detail/cancer-in-children (Erişim tarihi 13.08.23)
12. Jiles C, Wu E, Bernhardt MB, Kamalay S. Pediatric cancer treatment development. American College of Clinical Pharmacology. *PedSAP 2018 Book 1 Pediatric Oncology* 2018:p7-p25.
13. Özmekik Ö, Ulukapı I. Kemoterapi alan çocuklarda diş hekimliği yaklaşımı. *Acta Odontol Turc.* 2014;31:154-159.
14. Baykara O. Kanser tedavisinde güncel yaklaşımlar. Balıkesir *Sağlık Bil Derg.* 2016;5:154-165.
15. Ritwik P, Chrisentery-Singleton TE. Oral and dental considerations in pediatric cancers. *Cancer Metastasis Rev.* 2020;39(1):43-53. doi: 10.1007/s10555-020-09842-5.
16. Hong CH, daFonseca M. Considerations in the pediatric population with cancer. *Dent Clin North Am.* 2008;52(1):155-81, ix. doi: 10.1016/j.cden.2007.10.001.
17. Ritwik P. Dental care for patients with childhood cancers. *Ochsner J.* 2018;18(4):351-357. doi: 10.31486/toj.18.0061.
18. Epstein JB, Thariat J, Bensadoun RJ, et al. Oral complications of cancer and cancer therapy: from cancer treatment to survivorship. *CA Cancer J Clin.* 2012;62(6):400-422. doi: 10.3322/caac.21157.

19. Curra M, Soares Junior LAV, Martins MD, Santos PSDS. Chemotherapy protocols and incidence of oral mucositis. An integrative review. Einstein (Sao Paulo). 2018;16(1):eRW4007. doi: 10.1590/s1679-45082018rw4007.
20. Lalla RV, Sonis ST, Peterson DE. Management of oral mucositis in patients who have cancer. *Dent Clin North Am.* 2008;52(1):61-77, viii. doi: 10.1016/j.cden.2007.10.002.
21. Cant A, Bhujel N. Oral complications and dental management of childhood cancer: How does the dentist support integrated care? *JIDA*. 2021;67:4. doi: 10.58541/001c.71315.
22. Maria OM, Eliopoulos N, Muanza T. Radiation-Induced Oral Mucositis. *Front Oncol.* 2017;7:89. doi: 10.3389/fonc.2017.00089.
23. Proc P, Szczepańska J, Herud A, et al. Dental caries among childhood cancer survivors. *Medicine (Baltimore).* 2019;98(6):e14279. doi: 10.1097/MD.0000000000014279.
24. Peterson DE, Bensadoun RJ, Roila F, & ESMO Guidelines Working Group. Management of oral and gastrointestinal mucositis: ESMO clinical practice guidelines. *Annals of Oncology,* 2011;22(Suppl 6):vi78–vi84. doi: 10.1093/annonc/mdr391.
25. Glenny AM, Gibson F, Auld, E., et al. The development of evidence-based guidelines on mouth care for children, teenagers and young adults treated for cancer. *European Journal of Cancer,* 2010;46(8):1399–1412.
26. Velten DB, Zandonade E, Monteiro de Barros Miotto MH. Prevalence of oral manifestations in children and adolescents with cancer submitted to chemotherapy. *BMC Oral Health*. 2017;17(1):49. doi: 10.1186/s12903-016-0331-8.
27. Morgan JE, Hassan H, Cockle JV, Lethaby C, James B, Phillips RS. Critical review of current clinical practice guidelines for antifungal therapy in paediatric haematology and oncology. *Support Care Cancer.* 2017;25(1):221-228. doi: 10.1007/s00520-016-3412-y.
28. Dental management of pediatric patients receiving immunosuppressive therapy and/or radiation therapy. *Pediatric Dentistry,* 2018;40:392–400.
29. Ponce-Torres E, Ruiz-Rodriguez Mdel S, Alejo-Gonzalez, F et al. Oral manifestations in pediatric patients receiving chemotherapy for acute lymphoblastic leukemia. *The Journal of Clinical Pediatric Dentistry*, 2010;34(3):275–279. doi: 10.17796/jcpd.34.3.y-060151580h301t7.
30. Fleming P. Dental management of the pediatric oncology patient. *Current Opinion in Dentistry,* 1991;1(5):577–582.
31. Fayle SA, Curzon ME. Oral complications in pediatric oncology patients. *Pediatr Dent* 1991;13(5):289-295.
32. Näsman M, Forsberg CM, Dahllof G. Long-term dental development in children after treatment for malignant disease. *Eur J Orthod.* 1997;19:151–159. doi: 10.1093/ejo/19.2.151.
33. Seremidi K, Kloukos D, Polychronopoulou A, et al. Late effects of chemo and radiation treatment on dental structures of childhood cancer survivors. A systematic review and meta analysis. *Head Neck* 2019;41(9):3422-3433. doi: 10.1002/hed.25840.
34. Kang CM, Hahn SM, Kim HS, et al. Clinical risk factors influencing dental developmental disturbances in childhood cancer survivors. *Cancer Research and Treatment.* 2018;50(3):926–935. doi: 10.4143/crt.2017.296.
35. Gawade PL, Hudson MM., Kaste SC, et al. A systematic review of dental late effects in survivors of childhood cancer. *Pediatr Blood Cancer* 2014;61(3):407-416. doi: 10.1002/pbc.24842.

36. Krasuska-Sławińska E, Dembowska-Bagińska B, Brożyna A, et al. Changes in the chemical composition of mineralised teeth in children after antineoplastic treatment. *Contemp Oncol (Pozn).* 2018;22(1):37-41. doi: 10.5114/wo.2018.74392.
37. Pajari U, Lanning M.Developmental defects of teeth in survivors of childhood ALL are related to the therapy and age at diagnosis. *Med Pediatr Oncol.* 1995; 24:310-314.
38. Avsar A, Elli M, Darka O, Pinarli G. Long-term effects of chemotherapy on caries formation, dental development, and salivary factors in childhood cancer survivors. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics,* 2007;104(6):781–789. doi: 10.1016/j.tripleo.2007.02.029.
39. King E. Oral sequelae and rehabilitation considerations for survivors of childhood cancer. *British Dental Journal*, 2019;226(5):323–329. doi: 10.1038/s41415-019-0043-y.
40. Lauritano D, Petruzzi M. Decayed, missing and filled teeth index and dental anomalies in long-term survivors leukaemic children: A prospective controlled study. *Medicina Oral, Patología Oral y Cirugía Bucal,* 2012;17(6):977. doi: 10.4317/medoral.17955.
41. Nemeth O, Hermann P, Kivovics P, Garami M. Long-term effects of chemotherapy on dental status of children cancer survivors. *Pediatric Hematology and Oncology,* 2013;30(3):208–215. doi: 10.3109/08880018.2013.763391.
42. Dahllöf G, Forsberg C, Borgström B. Changes in craniofacial development induced by growth hormone therapy in children treated with bone marrow transplantation. *Acta Paediatr.* 1994;83:1165-1169.
43. Maguire A, Craft AW, Evans RG, et al. The long-term effects of treatment on the dental condition of children surviving malignant disease. *Cancer.* 1987;60:2570–2575.
44. Sonis AL, Tarbell N, Valachovic RW, Gelber R, Schwenn M, Sallan S. Dentofacial development in long-term survivors of acute lymphoblastic leukemia. A comparison of three treatment modalities. *Cancer.* 1990;66:2645–2652.
45. Kaste SC, Goodman P, Leisenring W, et al. Impact of radiation and chemotherapy on risk of dental abnormalities: a report from the Childhood Cancer Survivor Study. *Cancer.* 2009;115:5817-5827. doi: 10.1002/cncr.24670.
46. Mattos VD, Ferman S, Magalhães DMA, et al. Dental and craniofacial alterations in long-term survivors of childhood head and neck rhabdomyosarcoma. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2019;127(4):272-281. doi: 10.1016/j.oooo.2018.12.012.
47. Duggal MS, Curzon MEJ, Bailey CC, Lewis IJ, Prendergast M. Dental parameters in the long term survivors of childhood cancer compared with siblings. *Oral Oncol* 1997;33(5):348-353. doi: 10.1016/s1368-8375(97)89103-8.
48. Wogelius P, Dahllöf G, Gorst-Rasmussen A, et al. A population-based observational study of dental caries among survivors of childhood cancer. *Pediatr Blood Cancer* 2008;50(6):1221-1226. doi: 10.1002/pbc.21464.
49. Effinger KE, Migliorati CA, Hudson MM, et al. Oral and dental late effects in survivors of childhood cancer: A children's oncology group report. *Support Care Cancer.* 2014;22(7):2009–2019. doi: 10.1007/s00520-014-2260-x.
50. Sheller B, Williams B. Orthodontic management of patients with hematologic malignancies. *American Journal of Orthodontics and Dentofacial Orthopedics.* 1996;109(6):575–580. doi: 10.1016/s0889-5406(96)70068-9.
51. Dahllöf G, Jönsson A, Ulmner M, Huggare J. Orthodontic treatment in long-term survivors after pediatric bone marrow transplantation. *American Journal of Orthodontics and Dentofacial Orthopedics.* 2001;120(5):459–465. doi: 10.1067/mod.2001.118102.

52. Carpenter PA, Macmillan ML. Management of acute graft-versus-host disease in children. *Pediatric Clinics of North America*. 2010;57(1):273–295. doi: 10.1016/j.pcl.2009.11.007.
53. Baird K, Cooke K, Schultz KR. Chronic graftversus-host disease (GVHD) in children. *Pediatric Clinics of North America*. 2010;57(1):297–322. doi: 10.1016/j.pcl.2009.11.003.
54. Hord JFS. Policy statement: Standards for pediatric cancer centers. *Pediatrics*. 2014:134;410–414.
55. McGill BC, Wakefield C, Vetsch J, et al. "I remember how I felt, but I don't remember the gene": Families' experiences of cancer-related genetic testing in childhood. *Pediatric Blood & Cancer*. 2019:66(8);e27762. doi: 10.1002/pbc.27762
56. Landier W, Tse AM. Use of complementary and alternative medical interventions for the management of procedure-related pain, anxiety, and distress in pediatric oncology: An integrative review. *Journal of Pediatric Nursing*. 2010;25(6):566–579. doi: 10.1016/j.pedn.2010.01.009.
57. Policy on early childhood caries (ECC): Classifications, consequences, and preventive strategies. *Pediatric Dentistry*. 2017;39(6):59–61.
58. Clarkson JE, Eden OB. Dental health in children with cancer. *Archives of Disease in Childhood*. 1998;78(6):560–561.
59. Guideline on fluoride therapy. *Pediatric Dentistry*. 2016:38(6):181–184.
60. Guideline on caries-risk assessment and management for infants, children, and adolescents. *Pediatric Dentistry*. 2016;38(6):142–149.
61. Llena C, Forner L, Baca P. Anticariogenicity of casein phosphopeptide-amorphous calcium phosphate: A review of the literature. *The Journal of Contemporary Dental Practice*. 2009:10(3);1–9.
62. Katz J, Peretz, B. Trismus in a 6 year old child: A manifestation of leukemia? *The Journal of Clinical Pediatric Dentistry*. 2002;26(4):337–339. doi: 10.17796/jcpd.26.4.bk08734uj8q03245.
63. Rapidis AD, Dijkstra PU, Roodenburg JL, et al. Trismus in patients with head and neck cancer: Etiopathogenesis, diagnosis and management. *Clinical Otolaryngology*. 2015;40(6):516-526. doi: 10.1111/coa.12488.
64. Wang CJ, Huang EY, Hsu HC, et al. The degree and time-course assessment of radiation-induced trismus occurring after radiotherapy for nasopharyngeal cancer. *Laryngoscope*. 2005;115(8):1458–1460. doi: 10.1097/01.mlg.0000171019.80351.46.
65. Kumar N, Brooke A, Burke M, et al. The oral management of oncology patients requiring radiotherapy, chemotherapy and/or bone marrow transplantation. *FDJ* 2018;4(4):200-203.
66. Schubert MM, Sullivan KM, Truelove EL. Head and neck complications of bone marrow transplantation. In: Peterson DE, Elias EG, Sonis ST, eds. Head and Neck Management of the Cancer Patient. Boston: Martinus Nijhoff. 1986. p. 401-407.
67. Hudspeth M, Symons H. Hematology. In: Gunn VL, Nechyba C. The Harriet Lane Handbook. 16th ed. Philadelphia: Mosby. 2002. p. 283-306.
68. Hartnett E, Krainovich-Miller B. Preventive dental care: An educational program to integrate oral care into pediatric oncology. *Clinical Journal of Oncology Nursing*. 2017;21(5):611–616. doi: 10.1188/17.CJON.611-616.
69. Cubukcu CE, Gunes AM. Caries experience of leukemic children during intensive course of chemotherapy. *The Journal of Clinical Pediatric Dentistry*. 2008;32(2):155–158.

70. Huebner CE, Riedy CA. Behavioral determinants of brushing young children's teeth: implications for anticipatory guidance. *Pediatr Dent.* 2010;32(1):48-55.
71. Ivaturi A, Seth R, Priya H, The application of a conceptual framework to integrate oral health in childhood cancer care, *Pediatric Hematology Oncology Journal.* 2021;6(4):201-202.
72. Gupta A, Marwaha M, Bansal K, Sachdeva A, Gupta A. Dental Awareness among Parents and Oral Health of Paediatric Cancer Patients Receiving Chemotherapy. *J Clin Diagn Res.* 2016;10(5):ZC92-5. doi: 10.7860/JCDR/2016/17412.7819.
73. Paro D, Paro J, Ferreira LM. O enfermeiro e o cuidar em oncologia pediátrica. *Arq Ciênc Saúde*. 2005;12:151-157.
74. Sampaio MEA, Bezerra PMM, Santos FGD, et al. A hospital-based oral health education program impacts in pediatric cancer patients-A pilot study. *Spec Care Dentist*. 2023 Mar 9. doi: 10.1111/scd.12847.
75. Bezerra PMM, Sampaio MEA, Dos Santos FG, et al. The effectiveness of an oral health education and prevention program on the incidence and severity of oral mucositis in pediatric cancer patients: a non-randomized controlled study. *Support Care Cancer.* 2021;29(12):7877-7885. doi: 10.1007/s00520-021-06387-3.
76. Ghaffari M, Rakhshanderou S, Safari-Moradabadi A, Torabi S. Oral and dental health care during pregnancy: evaluating a theory-driven intervention. *Oral Dis.* 2018;24:1606–1614. doi: 10.1111/odi.12928.
77. Kemp G, Hallbourg M, Altounji D, Secola R. Back to basics: CLABSI reduction through implementation of an oral care and hygiene bundle. *J Pediatr Oncol Nurs Off J Assoc Pediatr Oncol Nurses.* 2019;36:321–326. doi: 10.1177/1043454219849583.
78. Chen CF, Wang RH, Cheng SN, Chang YC. Assessment of chemotherapy-induced oral complications in children with cancer. *J Pediatr Oncol Nurs.* 2004;21:33–39. doi: 10.1177/1043454203259947.
79. Cheng KK, Molassiotis A, Chang AM. An oral care protocol intervention to prevent chemotherapy-induced oral mucositis in paediatric cancer patients: a pilot study. *Eur J Oncol Nurs.* 2002;6(2):66–73. doi: 10.1054/ejon.2001.0161.
80. Cheng KK, Molassiotis A, Chang AM et al. Evaluation of an oral care protocol intervention in the prevention of chemotherapy-induced oral mucositis in paediatric cancer patients. *Eur J Cancer.* 2001;37:2056–2063. doi: 10.1016/s0959-8049(01)00098-3.
81. Qutob AF, Allen G, Gue S et al. Implementation of a hospital oral care protocol and recording of oral mucositis in children receiving cancer treatment : a retrospective and a prospective study. *Support Care Cancer.* 2013;21(4):1113–1120. doi: 10.1007/s00520-012-1633-2.
82. Okby OM, El-abbassy AA. Effect of implementing oral care guideline on the degree of oral mucositis among children receiving chemotherapy. *OSR Journal of Nursing and Health Science.* 2017;6:100–110. doi:: 10.9790/1959-060105100110.
83. Yavuz B, Bal Yilmaz H. Investigation of the effects of planned mouth care education on the degree of oral mucositis in pediatric oncology patients. *J Pediatr Oncol Nurs.* 2015:32(1):47–56. doi: 10.1177/1043454214554011.

Bölüm 18

GELENEKSEL DENTAL ENJEKSİYONA ALTERNATİF GÜNCEL LOKAL ANESTEZİ UYGULAMALARI

Büşra ALMAS[1]
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Diş hekimliğinde, özellikle de çocuk diş hekimliğinde başarıyı etkileyen faktörlerden biri ağrı kontrolüdür. Lokal anestezi, çocuk diş hekimliğinde ağrı kontrol tekniklerinin bel kemiğini oluşturur. Lokal anestezikler, ağrının önlenmesi ve yönetimi için tıbbi uygulamalarda güvenli ve etkili ilaçlardır. Lokal anestezik ilaçların uygulanması, çoğu hasta için diş randevusunun en korkutucu ve rahatsız edici kısmıdır. Lokal anesteziklerin verilmesi için kullanılan iğne, hastada en korku uyandıran parçadır. İğne fobisi ve iğne batma yaralanmaları göz önüne alındığında iğne kullanımını ortadan kaldıran bir yöntem bulma ihtiyacı daha da belirgin hale gelmiştir. Bunlar arasında bilgisayar kontrollü lokal anestezik dağıtım sistemleri, jet enjektörler, kemik içi sistemler, vibrotaktil cihazlar, güvenli diş şırıngaları ve diş bandı yer alır. Bu derlemenin amacı, diş hekimliğine kullanılan güncel anestezi sistemlerini tanıtmak, bu sistemlerin avantaj ve dezavantajlarını belirtmek ve nasıl kullanıldıklarını anlatmaktır.

1. GİRİŞ

Diş hekimliğinde uygulanan farmakolojik ajanların birçoğu anksiyete durumunu ve ağrıyı yönetmek için kullanılmaktadır. Diş hekimliğinde, tedaviler sırasında açığa çıkabilecek ağrı hissinin yok edilmesi için lokal anestezi kullanılır. Lokal anestezi periferik olarak ağrı algısını bloke eder. Anksiyetenin kontrol altına alınması için farmakolojik ve farmakolojik olmayan teknikler kullanılır. Anksiyete ve ağrı birbiriyle ilişkilidir (1).

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KAYNAKÇA

1. McLenon J, Rogers MAM. The fear of needles: A systematic review and meta-analysis. *Journal of Advanced Nursing.* 2019;75(1):30-42. doi: 10.1111/jan.13818
2. Johnsen JK, Eggesvik TB, Rorvik TH, Hanssen MW, Wynn R, Kummervold PE. Differences in Emotional and Pain-Related Language in Tweets About Dentists and Medical Doctors: Text Analysis of Twitter Content. *Journal of Medical Internet Research Public Health Surveill.* 2019;5(1):e10432. doi: 10.2196/10432
3. Gao X, Hamzah SH, Yiu CK, McGrath C, King NM. Dental fear and anxiety in children and adolescents: qualitative study using YouTube. *Journal of Medical Internet Research.* 2013;15(2):e29. doi: 10.2196/jmir.2290
4. Ceylan B, Günay Molu N. COVID-19 Salgını Sırasında Anne Babaların Kaygı Düzeyi. *Genel Sağlık Bilimleri Dergisi*; 2022;4(3):278-87. doi: 10.51123/jgehes.2022.64
5. Yakut K ve Işık BK. Beyaz Önlük veya Yeşil Ameliyathane Önlüğü Giyen Hekim Tarafından Yapılan Muayenenin Preoperatif Dental Anksiyete Üzerine Etkisinin Karşılaştırılması. *Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi;* 2020;2(3):113-6. doi: 10.51122/neudentj.2021.5
6. Shilpapriya M, Jayanthi M, Reddy VN, Sakthivel R, Selvaraju G, Vijayakumar P. Effectiveness of new vibration delivery system on pain associated with injection of local anesthesia in children. *Journal of the Indian Society of Pedodontics and Preventive Dentistry.* 2015;33(3):173-6. doi: 10.4103/0970-4388.160343
7. Abdelmoniem SA, Mahmoud SA. Comparative evaluation of passive, active, and passive-active distraction techniques on pain perception during local anesthesia administration in children. *Journal of advanced research.* 2016;7(3):551-6. doi: 10.1016/j.jare.2015.10.001
8. Yildirim S, Tokuc M, Aydin MN. The effect of pre-anesthesia with a needle-free system versus topical anesthesia on injection pain of the inferior alveolar nerve block: a randomized clinical trial. *Clinical Oral Investigations.* 2020;24(12):4355-61. doi: 10.1007/s00784-020-03301-9
9. Demir P, Duman S, Akdağ U, Saraç O, Duruk G. Genel Anestezi Altında Diş Tedavisi Sonrası Hastaların Postoperatif Konforunun Değerlendirilmesi. *Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi;* 2021;3(1):7-13. doi: 10.51122/neudentj.2021.9
10. Al-Omari WM, Al-Omiri MK. Dental anxiety among university students and its correlation with their field of study. *Journal of Applied Oral Science.* 2009;17(3):199-203. doi: 10.1590/s1678-77572009000300013
11. Kaufman E, Weinstein P, Milgrom P. Difficulties in achieving local anesthesia. *The Journal of the American Dental Association.* 1984;108(2):205-8. doi: 10.14219/jada.archive.1984.0470
12. Ring ME. The history of local anesthesia. *Journal of the California Dental Association.* 2007;35(4):275-82.
13. Ovalıoğlu Z, Bozkurt DA, Akman M. Covid-19 Pandemi Sürecinde Endodonti Kliniğine Gelen Hasta Anksiyete Düzeyi. *Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi;* 2020;2(3):98-102 doi: 10.51122/neudentj.2021.3
14. Tekin Atay Ü, Dinçer NN, Uçan Yarkaç F, Öncü E. Covid-19 Pandemi Sürecinde Diş Hekimliği Uzmanlık Öğrencilerinin Korku ve Anksiyete Düzeylerinin Değerlendirilmesi. *Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi;* 2020;2(3): 86-93. doi: 10.51122/neudentj.2020.1

15. McDonald RI, Walsh LJ, Savage NW. Analysis of workplace injuries in a dental school environment. *Australian Dental Journal.* 1997;42(2):109-13. doi: 10.1111/j.1834-7819.1997.tb00105.x
16. Siew C, Gruninger SE, Miaw CL, Neidle EA. Percutaneous injuries in practicing dentists. A prospective study using a 20-day diary. *The Journal of the American Dental Association.* 1995;126(9):1227-34. doi: 10.14219/jada.archive.1995.0357
17. Theocharidou A, Arhakis A, Kotsanos N, Arapostathis K. Jet or conventional local anaesthesia? A randomized controlled split mouth study. *Clinical Oral Investigations.* 2021;25(12):6813-9. doi: 10.1007/s00784-021-03968-8
18. Hingson RA, Hughes JG. Clinical studies with jet injection; a new method of drug administration. *Current researches in anesthesia & analgesia.* 1947;26(6):221-30.
19. Schmidt DA. Anesthesia by jet-injection in the practice of pedodontics. *Journal of Dentistry for Children.* 1966;33(6):340-52.
20. Bennett CR, Monheim LM. Production of local anesthesia by jet injection. A clinical study. *Oral Surgery, Oral Medicine, and Oral Pathology.* 1971;32(4):526-30. doi: 10.1016/0030-4220(71)90315-x
21. Lamprianidis T, Rood JP, Sowray JH. Dental analgesia by jet injection. *British Journal of Oral Surgery.* 1979;17(3):227–231.
22. Makade CS, Shenoi PR, Gunwal MK. Comparison of acceptance, preference and efficacy between pressure anesthesia and classical needle infiltration anesthesia for dental restorative procedures in adult patients. *Journal of Conservative Dentistry.* 2014;17(2):169-74. doi: 10.4103/0972-0707.128063
23. Saleh G, Michaelis A, Lang H, Raab W. Anaesthetic effective potential of a needle-free injection system. *Quintessenz.* 2002;53(9): 913–920.
24. Oliveira ACA, Amorim KS, Nascimento Junior EMD, Duarte ACB, Groppo FC, Takeshita WM, et al. Assessment of anesthetic properties and pain during needleless jet injection anesthesia: a randomized clinical trial. *Journal of Applied Oral Science.* 2019;27:e20180195. doi: 10.1590/1678-7757-2018-0195
25. Gelb AW, Morriss WW, Johnson W, Merry AF, Abayadeera A, Belii N, et al. World Health Organization-World Federation of Societies of Anaesthesiologists (WHO-WFSA) International Standards for a Safe Practice of Anesthesia. *Anesthesia and analgesia.* 2018;126(6):2047-55. doi: 10.1213/ANE.0000000000002927
26. St George G, Morgan A, Meechan J, Moles DR, Needleman I, Ng YL, et al. Injectable local anaesthetic agents for dental anaesthesia. *The Cochrane Database of Systematic Reviews.* 2018;7(7):CD006487. doi: 10.1002/14651858.CD006487.pub2
27. Weisenberg M. Cognitive aspects of pain and pain control. *The International journal of clinical and experimental hypnosis.* 1998;46(1):44-61. doi: 10.1080/00207149808409989
28. Weisenberg MI. Pain and pain control. *Psychological Bulletin.* 1977;84(5):1008-44.
29. Sezen İ, Işık BK, Menziletoğlu D. (2019). Hipnozun Diş Hekim-liğinde Kullanımı: Bir Derleme. *Necmettin Erbakan Üniversitesi Diş Hekimliği Dergisi.* 2019;1(1): 34-41.
30. McLure HA, Rubin AP. Review of local anaesthetic agents. *Minerva Anestesiologica.* 2005;71(3):59-74.
31. Dasarraju RK, Svsg N. Comparative efficacy of three topical anesthetics on 7-11-year-old children: a randomized clinical study. *Journal of Dental Anesthesia and Pain Medicine.* 2020;20(1):29-37. doi: 10.17245/jdapm.2020.20.1.29

32. Ujaoney S, Mamtani M, Thakre T, Tote J, Hazarey V, Hazarey P, et al. Efficacy trial of Camouflage Syringe to reduce dental fear and anxiety. *European journal of paediatric dentistry.* 2013;14(4):273-8.
33. Liu Y, Gu Z, Wang Y, Wu Q, Chen V, Xu X, et al. Effect of audiovisual distraction on the management of dental anxiety in children: A systematic review. *International Journal of Paediatric Dentistry.* 2019;29(1):14-21. doi: 10.1111/ipd.12430
34. Chopra R, Jindal G, Sachdev V, Sandhu M. Double-Blind Crossover Study to Compare Pain Experience During Inferior Alveolar Nerve Block Administration Using Buffered Two Percent Lidocaine in Children. *Pediatric Dentistry.* 2016;38(1):25-9.
35. Hameed NN, Sargod SS, Bhat SS, Hegde SK, Bava MM. Effectiveness of precooling the injection site using tetrafluorethane on pain perception in children. *Journal of the Indian Society of Pedodontics and Preventive Dentistry.* 2018;36(3):296-300. doi: 10.4103/JISPPD.JISPPD_222_17
36. Abbott K, Fowler-Kerry S. The use of a topical refrigerant anesthetic to reduce injection pain in children. *Journal of Pain and Symptom Management.* 1995;10(8):584-90. doi: 10.1016/0885-3924(95)00086-0
37. Harbert H. Topical ice: a precursor to palatal injections. *Journal of Endodontics.* 1989;15(1):27-8. doi: 10.1016/S0099-2399(89)80094-9
38. Duncan JD, Reeves GW, Fitchie JG. Technique to diminish discomfort from the palatal injection. *The Journal of Prosthetic Dentistry.* 1992;67(6):901-2. doi: 10.1016/0022-3913(92)90617-j
39. Kosaraju A, Vandewalle KS. A comparison of a refrigerant and a topical anesthetic gel as preinjection anesthetics: a clinical evaluation. *The Journal of the American Dental Association.* 2009;140(1):68-72. doi: 10.14219/jada.archive.2009.0020
40. Jayasuriya NSS, Weerapperuma ID, Amarasinghe M. The use of an iced cotton bud as an effective pre-cooling method for palatal anaesthesia: A technical note. *Singapore Dental Journal.* 2017;38:17-9. doi: 10.1016/j.sdj.2017.07.001
41. Wiswall AT, Bowles WR, Lunos S, McClanahan SB, Harris S. Palatal anesthesia: comparison of four techniques for decreasing injection discomfort. *Northwest Dentistry.* 2014;93(4):25-9.
42. Claffey E, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. *Journal of Endodontics.* 2004;30(8):568-71. doi: 10.1097/01.don.0000125317.21892.8f
43. Baier K, Milgrom P, Russell S, Mancl L, Yoshida T. Children's fear and behavior in private pediatric dentistry practices. *Pediatric dentistry.* 2004;26(4):316-21.
44. Sokolowski CJ, Giovannitti JA, Jr., Boynes SG. Needle phobia: etiology, adverse consequences, and patient management. *Dental Clinics of North America.* 2010;54(4):731-44. doi: 10.1016/j.cden.2010.06.012
45. Fuller NP, Menke RA, Meyers WJ. Perception of pain to three different intraoral penetrations of needles. *The Journal of the American Dental Association.* 1979;99(5):822-4. doi: 10.14219/jada.archive.1979.0384
46. Wilburn SQ, Eijkemans G. Preventing needlestick injuries among healthcare workers: a WHO-ICN collaboration. *International journal of occupational and environmental health.* 2004;10(4):451-6. doi: 10.1179/oeh.2004.10.4.451
47. Ravi AD, Sadhna D, Nagpaal D, Chawla L. Needle free injection technology: A complete insight. *International journal of pharmaceutical investigation.* 2015;5(4):192-9. doi: 10.4103/2230-973X.167662

48. Munshi AK, Hegde A, Bashir N. Clinical evaluation of the efficacy of anesthesia and patient preference using the needle-less jet syringe in pediatric dental practice. *The Journal of Clinical Pediatric Dentistry.* 2001;25(2):131-6.
doi: 10.17796/jcpd.25.2.q6426p853266q575
49. Saravia ME, Bush JP. The needleless syringe: efficacy of anesthesia and patient preference in child dental patients. *The Journal of Clinical Pediatric Dentistry*. 1991;15(2):109-12.
50. Dabarakis NN, Alexander V, Tsirlis AT, Parissis NA, Nikolaos M. Needle-less local anesthesia: clinical evaluation of the effectiveness of the jet anesthesia Injex in local anesthesia in dentistry. *Quintessence International.* 2007;38(10):E572-6.
51. Kale TR, Momin M. Needle free injection technology-An overview. *Innovations in Pharmacy*. 2014;5(1): 148.
52. Mitragotri S. Current status and future prospects of needle-free liquid jet injectors. *Nature Reviews. Drug Discovery.* 2006;5(7):543-8. doi: 10.1038/nrd2076
53. Altan H, Belevcikli M, Cosgun A, Demir O. Comparative evaluation of pain perception with a new needle-free system and dental needle method in children: a randomized clinical trial. *BMC Anesthesiology.* 2021;21(1):301. doi: 10.1186/s12871-021-01524-1
54. https://www.needlefreereviews.com/the-comfort-in/amp/ (18.09.2023 tarihinde bu adresten ulaşılmıştır)
55. https://www.madamedical.com/category/madajet/ (18.09.2023 tarihinde bu adresten ulaşılmıştır)
56. Clark MS, Silverstone LM, Lindenmuth J, Hicks MJ, Averbach RE, Kleier DJ, et al. An evaluation of the clinical analgesia/anesthesia efficacy on acute pain using the high frequency neural modulator in various dental settings. *Oral Surgery, Oral Medicine, and Oral Pathology.* 1987;63(4):501-5. doi: 10.1016/0030-4220(87)90267-2
57. https://www.henryschein.ca/caen/dentalca/p/anesthetics/anesthetic-syringes/sleeve-silicone-f-syrijet/2420611 (18.09.2023 tarihinde bu adresten ulaşılmıştır)
58. Saxena P, Gupta SK, Newaskar V, Chandra A. Advances in dental local anesthesia techniques and devices: An update. *National Journal of Maxillofacial Surgery.* 2013;4(1):19-24. doi: 10.4103/0975-5950.117873
59. https://mitneedlefree.com/products/ (18.09.2023 tarihinde bu adresten ulaşılmıştır)
60. Shealy CN, Taslitz N, Mortimer JT, Becker DP. Electrical inhibition of pain: experimental evaluation. *Anesthesia and Analgesia.* 1967;46(3):299-305.
61. Thilak N, Hegde S, Bhat SS, Bhat V, Rajasekaran S, Mumtaz M. Delivery Systems of Local Anesthetics in Dentistry: An Update. *Acta Scientific Dental Science.* 2020; 4(5): 23-27.
62. Abdulhameed SM, Feigal RJ, Rudney JD, Kajander KC. Effect of peripheral electrical stimulation on measures of tooth pain threshold and oral soft tissue comfort in children. *Anesthesia Progress.* 1989;36(2):52-7.
63. Quarnstrom F. Electronic dental anesthesia. *Anesthesia Progress.* 1992;39(4-5):162-77.
64. Wilson S, Molina Lde L, Preisch J, Weaver J. The effect of electronic dental anesthesia on behavior during local anesthetic injection in the young, sedated dental patient. *Pediatric Dentistry.* 1999;21(1):12-7.
65. Meechan JG. Intra-oral topical anaesthetics: a review. *Journal of Dentistry.* 2000;28(1):3-14. doi: 10.1016/s0300-5712(99)00041-x

66. Friedman MJ, Hochman MN. A 21st century computerized injection system for local pain control. *Compendium of Continuing Education in Dentistry.* 1997;18(10):995-1000.
67. Angelo Z, Polyvios C. Alternative practices of achieving anaesthesia for dental procedures: a review. *Journal of Dental Anesthesia and Pain Medicine.* 2018;18(2):79-88. doi: 10.17245/jdapm.2018.18.2.79
68. Second YLK, Neelakantan P. Local anesthetics in dentistry-newer methods of delivery. *International Journal of Pharmaceutical and Clinical Research.* 2014; 6(1): 4-6.
69. Sharma SS, Aruna Sharma S, Saravanan C, Sathyabama. Newer local anaesthetic drugs and delivery systems in dentistry-an update. *Journal of Dental and Medical Sciences.* 2012;1(4): 10-16.
70. Santhosh Kumar MP. Newer Delivery Systems for Local Anesthesia in Dentistry. *Journal of Pharmaceutical Sciences and Research.* 2015;7(5): 252-255.
71. Hochman MN, Chiarello D, Hochman CB, Lopatkin R, Pergola S. Computerized Local Anesthesia Delivery vs. Traditional Syringe Technique. *The New York State Dental Journal.* 1997;63(7):24-9.
72. Ferrari M, Cagidiaco MC, Vichi A, Goracci C. Efficacy of the Computer-Controlled Injection System STATM, and the dental syringe for intraligamentary anesthesia in restorative patients. *International Dentistry SA.* 2008;11(1):4-12.
73. Sixou JL, Marie-Cousin A. Intraosseous anaesthesia in children with 4 % articaine and epinephrine 1:400,000 using computer-assisted systems. *European Archives of Paediatric Dentistry.* 2015;16(6):477-81. doi: 10.1007/s40368-015-0197-5
74. Sovatdy S, Vorakulpipat C, Kiattavorncharoen S, Saengsirinavin C, Wongsirichat N. Inferior alveolar nerve block by intraosseous injection with Quicksleeper(R) at the retromolar area in mandibular third molar surgery. *Journal of Dental Anesthesia and Pain Medicine.* 2018;18(6):339-47. doi: 10.17245/jdapm.2018.18.6.339
75. Smail-Faugeron V, Muller-Bolla M, Sixou JL, Courson F. Split-mouth and parallel-arm trials to compare pain with intraosseous anaesthesia delivered by the computerised Quicksleeper system and conventional infiltration anaesthesia in paediatric oral healthcare: protocol for a randomised controlled trial. *BMJ Open.* 2015;5(7):e007724. doi: 10.1136/bmjopen-2015-007724
76. https://www.medicalexpo.com/prod/dentalhitec/product-71964-705960.html (18.09.2023 tarihinde bu adresten ulaşılmıştır)
77. Nanitsos E, Vartuli R, Forte A, Dennison PJ, Peck CC. The effect of vibration on pain during local anaesthesia injections. *Australian Dental Journal.* 2009;54(2):94-100. doi: 10.1111/j.1834-7819.2009.01100.x
78. https://markhamdentist.ca/dental-technology/dentalvibe (18.09.2023 tarihinde bu adresten ulaşılmıştır)
79. Houpt MI, Heins P, Lamster I, Stone C, Wolff MS. An evaluation of intraoral lidocaine patches in reducing needle-insertion pain. *Compendium of Continuing Education in Dentistry.* 1997;18(4):309-10.
80. Wu SJ, Julliard K. Children's preference of benzocaine gel versus the lidocaine patch. *Pediatric Dentistry.* 2003;25(4):401-5.
81. Stecker SS, Swift JQ, Hodges JS, Erickson PR. Should a mucoadhesive patch (DentiPatch) be used for gingival anesthesia in children? *Anesthesia progress.* 2002;49(1):3-8.
82. https://www.dentalcompare.com/Reviews/2496-DentiPatch/ (1.1.2023 tarihinde bu adresten ulaşılmıştır)

83. Walsh LJ. Laser analgesia with pulsed infrared lasers: theory and practice. *Journal of Oral Laser Applications.* 2008;8(1):7-16.
84. Genovese MD, Olivi G. Laser in paediatric dentistry: patient acceptance of hard and soft tissue therapy. *European Journal of Paediatric Dentistry.* 2008;9(1):13-7.
85. Chan A, Armati P, Moorthy AP. Pulsed Nd: YAG laser induces pulpal analgesia: a randomized clinical trial. *Journal of Dental Research.* 2012;91(7):79S-84S. doi: 10.1177/0022034512447947

Bölüm 19

GÜMÜŞ DİAMİN FLORÜRLER

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GİRİŞ

Diş çürüğü, çocuklar arasında yaygın olarak görülen kronik bir hastalıktır (1). En yaygın çocukluk çağı hastalıkları arasında sayılan erken çocukluk çağı çürükleri (EÇÇ), küçük çocukların ve ailelerinin refahı için önemli bir tehdit oluşturmaktadır (2). EÇÇ, altı yaşın altındaki bir çocukta "herhangi bir süt dişinde bir veya daha fazla çürük (kavitesiz veya kaviteli lezyonlar), eksik (çürük nedeniyle) veya dolgulu diş yüzeyinin varlığı" olarak tanımlanmaktadır (3). Çocukluk çağındaki ağız sorunları, çocukların sadece ağız sağlığını değil, genel sağlıklarını ve yaşam kalitelerini de önemli ölçüde etkilemektedir (4).

Süt dişi çürüğünün önlenmesi ve yönetimi konusunda uzun yıllardır çalışmalar yürütülmesine rağmen, çürük önemli bir halk sağlığı sorunu olmaya devam etmektedir (5). Ayrıca, sosyoekonomik faktörler ve süt dişlerinin fizyolojik özellikleri nedeniyle, çocuklarda diş çürükleri kolayca ilerleyebilmektedir. Çürük, başlangıçta süt dişlerinin yüzeyinde beyaz nokta lezyonları olarak ortaya çıkar ve demineralizasyon giderek ilerler (6).

Genellikle, diş hekimi korkusu yaşayan ve diş hekimleriyle işbirliği sağlayamayan çocuklar diş çürükleri için komplike tedavilerin uygulanmasına izin vermeyebilirler. Bu durum, çocuklarla tedavi için yeterli koopeasyon sağlayamayan çocuk diş hekimleri için önemli bir zorluk teşkil etmektedir (7). Bu nedenle, EÇÇ'li çocuklar genellikle sedasyon veya genel anestezi altında kapsamlı diş tedavilerine ihtiyaç duyarlar (8).

Tedavi edilmeyen EÇÇ ağrıya, apseye, yemek yiyememe nedeniyle gelişimin aksamasına, uyku güçlüğüne ve genel sağlık durumunun kötüleşmesine yol açabilir (4, 9). Ebeveynlerin çocuklarını düzenli diş kontrolüne getirmemeleri, tedaviye

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dişlerin bazıları derin çürüklü lezyonlar olmasına rağmen GDF uygulaması sonrası herhangi bir diş ağrısı rapor edilmemiştir (63).

SONUÇ

Bugüne kadar yayınlanan çalışmalar ve klinik araştırma sonuçları, GDF'nin diş hekimliğinde diş çürüklerinin kontrolü de dahil olmak üzere farklı pek çok uygulamada kullanılabileceğini belirtmektedir. Küçük çocuklarda sıklıkla görülebilen diş çürükleri, yaşam kalitesini önemli ölçüde etkileyebilen ve görülme sıklığı giderek artan bir problemdir. GDF'nin topikal uygulaması, florozis veya sistemik toksisite riski olmaksızın çocuklarda yeni çürük lezyonların oluşmasını ve mevcut çürük lezyonlarının ilerlemesini önlemede yeterli etki gösterebilen, uygulaması basit, hızlı ve güvenle kullanılabilen bir tedavi yöntemidir. GDF yüksek çürük riskine sahip ve dental tedavilere erişimin kısıtlı olduğu hasta popülasyonlarında, özellikle süt dentisyondaki yeterli koruyucu etkisinden dolayı klinik uygulamalarda yaygın bir şekilde tercih edilen materyallere alternatif bir ajan olarak tavsiye edilmektedir. Basit uygulama süreci, daha az ekipman gerektirmesi ve uygulama başına düşük maliyeti nedeniyle geniş popülasyonlar için ideal olan GDF protokollerinin yüksek çürük insidansına sahip olan toplumlarda diş çürüklerinin yönetiminde yaygın olarak kullanılabileceği düşünülmektedir.

KAYNAKÇA

1. Bernabe E, Marcenes W. Can minimal intervention dentistry help in tackling the global burden of untreated dental caries? Br Dent J. 2020;229(7):487-91.
2. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2163-96.
3. Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies. Pediatr Dent. 2018;40(6):60-2.
4. Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. Br Dent J. 2006;201(10):625-6.
5. Wen PYF, Chen MX, Zhong YJ, Dong QQ, Wong HM. Global Burden and Inequality of Dental Caries, 1990 to 2019. J Dent Res. 2022;101(4):392-9.
6. Kagihara LE, Niederhauser VP, Stark M. Assessment, management, and prevention of early childhood caries. J Am Acad Nurse Pract. 2009;21(1):1-10.
7. Li JY, He SY, Wang PX, Dai SS, Zhang SQ, Li ZY, et al. Incidence and risk factors of unplanned retreatment following dental general anesthesia in children with severe early childhood caries. Front Pediatr. 2023;11:1163368.
8. Oubenyahya H, Bouhabba N. General anesthesia in the management of early childhood caries: an overview. J Dent Anesth Pain Med. 2019;19(6):313-22.

9. Acs G, Shulman R, Ng MW, Chussid S. The effect of dental rehabilitation on the body weight of children with early childhood caries. Pediatr Dent. 1999;21(2):109-13.
10. Weir E. Dental caries: a nation divided. CMAJ. 2002;167(9):1035.
11. Twetman S. Caries prevention with fluoride toothpaste in children: an update. Eur Arch Paediatr Dent. 2009;10(3):162-7.
12. Broadbent JM, Thomson WM, Ramrakha S, Moffitt TE, Zeng J, Foster Page LA, et al. Community Water Fluoridation and Intelligence: Prospective Study in New Zealand. Am J Public Health. 2015;105(1):72-6.
13. Chibinski AC, Wambier LM, Feltrin J, Loguercio AD, Wambier DS, Reis A. Silver Diamine Fluoride Has Efficacy in Controlling Caries Progression in Primary Teeth: A Systematic Review and Meta-Analysis. Caries Res. 2017;51(5):527-41.
14. Crystal YO, Rabieh S, Janal MN, Rasamimari S, Bromage TG. Silver and fluoride content and short-term stability of 38% silver diamine fluoride. J Am Dent Assoc. 2019;150(2):140-6.
15. Peng JJ, Botelho MG, Matinlinna JP. Silver compounds used in dentistry for caries management: a review. J Dent. 2012;40(7):531-41.
16. Rosenblatt A, Stamford TC, Niederman R. Silver diamine fluoride: a caries "silver-fluoride bullet". J Dent Res. 2009;88(2):116-25.
17. Yamaga R. Arrestment of caries of deciduous teeth with diamine silver fluoride. Dental Outlook. 1969;33:1007-13.
18. Chu CH, Lo EC. Promoting caries arrest in children with silver diamine fluoride: a review. Oral Health Prev Dent. 2008;6(4):315-21.
19. Gao SS, Zhao IS, Hiraishi N, Duangthip D, Mei ML, Lo ECM, et al. Clinical Trials of Silver Diamine Fluoride in Arresting Caries among Children: A Systematic Review. JDR Clin Trans Res. 2016;1(3):201-10.
20. Mei ML, Chu CH, Lo EC, Samaranayake LP. Fluoride and silver concentrations of silver diammine fluoride solutions for dental use. Int J Paediatr Dent. 2013;23(4):279-85.
21. Yee R, Holmgren C, Mulder J, Lama D, Walker D, van Palenstein Helderman W. Efficacy of silver diamine fluoride for Arresting Caries Treatment. J Dent Res. 2009;88(7):644-7.
22. Romao DA, Fernandez CE, de Melo Santos L. Commercial Silver Diamine Fluoride (SDF) Products on Caries Lesion Progression in Primary Enamel: An In Vitro Study. Oral Health Prev Dent. 2020;18(1):1025-9.
23. Jabin Z, Vishnupriya V, Agarwal N, Nasim I, Jain M, Sharma A. Effect of 38% silver diamine fluoride on control of dental caries in primary dentition: A Systematic review. J Family Med Prim Care. 2020;9(3):1302-7.
24. Horst JA. Silver Fluoride as a Treatment for Dental Caries. Adv Dent Res. 2018;29(1):135-40.
25. Crystal YO, Marghalani AA, Ureles SD, Wright JT, Sulyanto R, Divaris K, et al. Use of Silver Diamine Fluoride for Dental Caries Management in Children and Adolescents, Including Those with Special Health Care Needs. Pediatr Dent. 2017;39(5):135-45.
26. Mei ML, Lo EC, Chu CH. Clinical Use of Silver Diamine Fluoride in Dental Treatment. Compend Contin Educ Dent. 2016;37(2):93-8; quiz100.
27. Zhao IS, Gao SS, Hiraishi N, Burrow MF, Duangthip D, Mei ML, et al. Mechanisms of silver diamine fluoride on arresting caries: a literature review. Int Dent J. 2018;68(2):67-76.

28. Seifo N, Robertson M, MacLean J, Blain K, Grosse S, Milne R, et al. The use of silver diamine fluoride (SDF) in dental practice. Br Dent J. 2020;228(2):75-81.
29. Youravong N, Carlen A, Teanpaisan R, Dahlen G. Metal-ion susceptibility of oral bacterial species. Lett Appl Microbiol. 2011;53(3):324-8.
30. Mei ML, Li QL, Chu CH, Yiu CK, Lo EC. The inhibitory effects of silver diamine fluoride at different concentrations on matrix metalloproteinases. Dent Mater. 2012;28(8):903-8.
31. Horst JA, Ellenikiotis H, Milgrom PL. UCSF Protocol for Caries Arrest Using Silver Diamine Fluoride: Rationale, Indications and Consent. J Calif Dent Assoc. 2016;44(1):16-28.
32. Knight GM, McIntyre JM, Craig GG, Mulyani, Zilm PS, Gully NJ. Differences between normal and demineralized dentine pretreated with silver fluoride and potassium iodide after an in vitro challenge by Streptococcus mutans. Aust Dent J. 2007;52(1):16-21.
33. Wakshlak RB, Pedahzur R, Avnir D. Antibacterial activity of silver-killed bacteria: the "zombies" effect. Sci Rep. 2015;5:9555.
34. Crystal YO, Niederman R. Evidence-Based Dentistry Update on Silver Diamine Fluoride. Dent Clin North Am. 2019;63(1):45-68.
35. Clemens J, Gold J, Chaffin J. Effect and acceptance of silver diamine fluoride treatment on dental caries in primary teeth. J Public Health Dent. 2018;78(1):63-8.
36. Chhokar SK, Laughter L, Rowe DJ. Perceptions of Registered Dental Hygienists in Alternative Practice Regarding Silver Diamine Fluoride. J Dent Hyg. 2017;91(4):53-60.
37. Chu CH, Lo EC, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. J Dent Res. 2002;81(11):767-70.
38. Houpt M. Topical application of silver diamine fluoride may arrest dental caries. Journal of Evidence Based Dental Practice. 2011;11(1):54-5.
39. Hamama H, Yiu C, Burrow M. Effect of silver diamine fluoride and potassium iodide on residual bacteria in dentinal tubules. Australian dental journal. 2015;60(1):80-7.
40. Li R, Lo E, Chu C, Liu B, editors. Arresting root caries through fluoride applications: 2-year result. Journal of Dental Research Meeting Abstracts; 2015: Sage Publications, Inc.
41. Crystal YO, Janal MN, Hamilton DS, Niederman R. Parental perceptions and acceptance of silver diamine fluoride staining. J Am Dent Assoc. 2017;148(7):510-8 e4.
42. Bhadule SN, Kalaskar R. Role of silver diamine fluoride in caries prevention: A narrative review. SRM Journal of Research in Dental Sciences. 2021;12(4):210.
43. Ravald N, Hamp SE, Birkhed D. Long-term evaluation of root surface caries in periodontally treated patients. J Clin Periodontol. 1986;13(8):758-67.
44. Cappelli DP, Mobley CC. Prevention in clinical oral health care: Elsevier Health Sciences; 2007.
45. Locker D, Slade GD, Murray H. Epidemiology of periodontal disease among older adults: a review. Periodontol 2000. 1998;16:16-33.
46. Holm-Pedersen P, Agerbaek N, Theilade E. Experimental gingivitis in young and elderly individuals. J Clin Periodontol. 1975;2(1):14-24.
47. Alshehri W. Effect of Silver diamine fluoride on the treatment of gingivitis in geriatric patients 2020.

48. Mathew VB, Madhusudhana K, Sivakumar N, Venugopal T, Reddy RK. Anti-microbial efficiency of silver diamine fluoride as an endodontic medicament - An ex vivo study. Contemp Clin Dent. 2012;3(3):262-4.
49. Wong MC, Lam KF, Lo EC. Analysis of multilevel grouped survival data with time-varying regression coefficients. Stat Med. 2011;30(3):250-9.
50. Page RC, Schroeder HE. Pathogenesis of inflammatory periodontal disease. A summary of current work. Lab Invest. 1976;34(3):235-49.
51. Zhi QH, Lo EC, Lin HC. Randomized clinical trial on effectiveness of silver diamine fluoride and glass ionomer in arresting dentine caries in preschool children. J Dent. 2012;40(11):962-7.
52. Garg S, Sadr A, Chan D. Potassium Iodide Reversal of Silver Diamine Fluoride Staining: A Case Report. Oper Dent. 2019;44(3):221-6.
53. Özgül M. Süt dişlerinin başlangıç çürüklerinde remineralizasyon ajanı olarak kullanılan"sodyum florür cila, gümüş diamin florürsolüsyonu ve kazein fosfopeptit-amorf kalsiyum fosfat"hakkında, 0-6 yaş grubu çocukların velilerinin bilgi düzeylerininölçülmesi ve görüşlerinin değerlendirilmesi. 2022.
54. Hu S, Meyer B, Duggal M. A silver renaissance in dentistry. Eur Arch Paediatr Dent. 2018;19(4):221-7.
55. LaMay A. Evaluation of Silver Diamine Fluoride in Reduction of Plaque and Salivary Oral Bacteria in Children with Early Childhood Caries (ECC): University of Illinois at Chicago; 2020.
56. Fung MHT, Duangthip D, Wong MCM, Lo ECM, Chu CH. Randomized Clinical Trial of 12% and 38% Silver Diamine Fluoride Treatment. J Dent Res. 2018;97(2):171-8.
57. Duangthip D, Fung MHT, Wong MCM, Chu CH, Lo ECM. Adverse Effects of Silver Diamine Fluoride Treatment among Preschool Children. J Dent Res. 2018;97(4):395-401.
58. Llodra JC, Rodriguez A, Ferrer B, Menardia V, Ramos T, Morato M. Efficacy of silver diamine fluoride for caries reduction in primary teeth and first permanent molars of schoolchildren: 36-month clinical trial. J Dent Res. 2005;84(8):721-4.
59. DenBesten P, Li W. Chronic fluoride toxicity: dental fluorosis. Monogr Oral Sci. 2011;22:81-96.
60. Bora P, Nangia T, Saxena A, Kunchok T, Sangal A. Silver diamine fluoride: Role in management of dental caries. Int J Appl Dent Sci. 2022;8:384-91.
61. Burgess JO, Vaghela PM. Silver Diamine Fluoride: A Successful Anticarious Solution with Limits. Adv Dent Res. 2018;29(1):131-4.
62. Vasquez E, Zegarra G, Chirinos E, Castillo JL, Taves DR, Watson GE, et al. Short term serum pharmacokinetics of diammine silver fluoride after oral application. BMC Oral Health. 2012;12:60.
63. Milgrom P, Horst JA, Ludwig S, Rothen M, Chaffee BW, Lyalina S, et al. Topical silver diamine fluoride for dental caries arrest in preschool children: A randomized controlled trial and microbiological analysis of caries associated microbes and resistance gene expression. J Dent. 2018;68:72-8.

Bölüm 20

BAŞLANGIÇ MİNE ÇÜRÜKLERİ ve TEŞHİSİNDE KULLANILAN YÖNTEMLER

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BAŞLANGIÇ MİNE ÇÜRÜĞÜNÜN TANIMI

Ağız içi ortamda uzun süreli pH'ın düşük olduğu durumlarda; mine yüzeyi erken safhalarda bozulmadan kalmakta ancak mine yüzeyinin altındaki bölgede az miktarda mineral kaybı meydana gelmektedir. Mine ile sınırlı olan bu çürük lezyonlarında, yüzey neredeyse hiç bozulmamış olup poröz bir yüzey altı bölge gözlemlenmektedir. Bu lezyonlar başlangıç mine çürüğü (BMÇ) olarak adlandırılmaktadır (1).

BAŞLANGIÇ MİNE ÇÜRÜĞÜNÜN HİSTOLOJİSİ

Histolojik olarak incelendiğinde; BMÇ 4 farklı tabakadan oluşmaktadır. Bu tabakalar içten dışa doğru sıralandığında;

- Saydam tabaka
- Karanlık tabaka
- Lezyon gövdesi
- Yüzeyel bölge şeklindedir (2).

1. Saydam tabaka

Saydam tabaka diğer adıyla translüsent bölge, çürüğün en derin tabakasıdır ve çürük lezyonunu sağlıklı mineden ayırır. Mine çürüğü içerisine kinolin sıvısı doldurulup polarize ışık mikroskobunda incelendiğinde, bu bölge translüsent olarak görünür. Bu tabaka, normal mineye göre 10 kat daha poröz bir yapıdadır. Retzius çizgileri ve enine prizma çizgileri tamamen yok olmuş ya da oldukça azalmıştır. Bu tabakada asit penetrasyonu daha yeni gelişmektedir ve bu sayede

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Bu derleme, HARMAN EB. Süt dişlerinde nanoteknolojik ürünler ile bitkisel kaynaklı ajanların remineralizasyon etkinliğinin in-vitro olarak incelenmesi, D.Ü. Diş Hekimliği Fakültesi, Uzmanlık Tezi, 2023, Diyarbakır. (Danışman: Doç. Dr. Ebru Akleyin) adlı tezden üretilmiştir.

KAYNAKLAR

1. Anderson P, Hector MP, Rampersad MA. Critical pH in resting and stimulated whole saliva in groups of children and adults. *Int J Paediatr Dent*. 2001; 11(4): 266-273.
2. Featherstone JDB. Dental caries: a dynamic disease process. *Aust Dent J*. 2008; 53(3): 286-291.
3. González-Cabezas C. The chemistry of caries: remineralization and demineralization events with direct clinical relevance. *Dent Clin North Am*. 2010; 54(3): 469-478.
4. Featherstone JDB. The science and practice of caries prevention. *J Am Dent Assoc.* 2000;131(7): 887-899.
5. Yıkılgan İ, Kılıç HS. Diş Çürüğü ve Diş Sert Dokuları. T*ürkiye Klinikleri J Retro Dent-Special Topics*. 2016; 2(1): 5-8.
6. Ok E. Güncel fissür örtücü materyallerin mine remineralizasyonuna katkısının in-vitro olarak incelenmesi, D.Ü. Diş Hekimliği Fakültesi, Uzmanlık Tezi, 2017, Diyarbakır (Danışman: Prof. Dr. Sema ÇELENK).
7. Darling AI. The selective attack of caries on the dental enamel. *Ann R Coll Surg Engl.* 1961; 29(6): 369.
8. Gümüş S. Güncel remineralizasyon ajanlarının mine üzerine etkisinin farklı yöntemlerle değerlendirilmesi, D.Ü. Diş Hekimliği Fakültesi, Uzmanlık Tezi, 2021, Diyarbakır (Danışman: Doç. Dr. Elif Pınar BAKIR).
9. Zero DT. Dentifrices, mouthwashes, and remineralization/caries arrestment strategies. *BMC Oral Health*. 2006; 6(1): 1-13.
10. Çelik EU, Yazkan B, Katırcı G. Başlangıç çürük lezyonlarının tedavisi. *Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi.* 2011; 21(1): 48-56.
11. Holmen L, Thylstrup A, Artun J. Clinical and histological features observed during arrestment of active enamel carious lesions in vivo. *Caries Res.* 1987; 21(6): 546-554.
12. Düzdar L, Menteş A, Okar İ. Süt dişi minesinin beyaz lezyonlarının tarama elektron mikroskopta (SEM) incelenmesi. *J Istanb Univ Fac Dent*. 1992; 26(3): 131-134.
13. Anderson P, Elliott JC. Subsurface demineralization in dental enamel and other permeable solids during acid dissolution. *J Dent Res.* 1992;71(8):1473-1481.
14. Ingram GS, Silverstone LM. A chemical and histological study of artificial caries in human dental enamel in vitro. *Caries Res.* 1981; 15(5): 393-398.
15. Anderson P, Elliott JC. Subsurface demineralization in dental enamel and other permeable solids during acid dissolution. *J Dent Res.* 1992; 71(8): 1473-1481.
16. Rugg-Gunn A. Dental caries: strategies to control this preventable disease. *Acta Med Acad.* 2013; 42(2): 117-130
17. Heymann GC, Grauer D. A contemporary review of white spot lesions in orthodontics. *J Esthet Restor Dent.* 2013; 25(2): 85-95.
18. Heymann GC, Grauer D. A contemporary review of white spot lesions in orthodontics. *J Esthet Restor Dent.* 2013; 25(2): 85-95.

19. Cury JA, Tenuta LMA. Enamel remineralization: controlling the caries disease or treating early caries lesions? *Braz Oral Res*. 2009; 23(1): 23-30.
20. Pretty IA, Ekstrand KR. Detection and monitoring of early caries lesions: a review. *Eur Arch Paediatr Dent.* 2016;17(1):13-25.
21. Pitts N. "ICDAS"—an international system for caries detection and assessment being developed to facilitate caries epidemiology, research and appropriate clinical management. *Community Dent Health*. 2004; 21:193–198.
22. Gürses M, Ünlü N. Okluzal çürük teşhis yöntemlerine güncel bakış. *Selcuk Dental Journal.* 2017; 4(3): 153-161.
23. Huang TTY, He LH, Darendeliler MA, Swain M v. Nano-indentation characterisation of natural carious white spot lesions. *Caries Res.* 2010; 44(2): 101-107.
24. Pretty IA, Ekstrand KR. Detection and monitoring of early caries lesions: a review. *Eur Arch Paediatr Dent.* 2016;17(1): 13-25
25. Versteeg CH, Sanderink GCH, van der Stelt PF. Efficacy of digital intra-oral radiography in clinical dentistry. *J Dent.* 1997; 25(3-4): 215-224.
26. Lussi A, Hibst R, Paulus R. DIAGNOdent: an optical method for caries detection. *J Dent Res.* 2004; 80-83.
27. Korkut B, Tağtekin DA, Yanıkoğlu FÇ. Diş Çürüklerinin Erken Teşhisi ve Teşhiste Yeni Yöntemler: QLF, Diagnodent, Elektriksel İletkenlik ve Ultrasonik Sistem. *EÜ Dişhek Fak Derg*. 2011;32:55-67.
28. Ersöz E, Oktay N. Alternatif çürük tespit yöntemleri. *Atatürk Üniversitesi Diş Hekimliği Fakültesi Dergisi.* 2002; 12(2): 56-63.
29. Abogazalah N, Eckert GJ, Ando M. In vitro visual and visible light transillumination methods for detection of natural non-cavitated approximal caries. *Clin Oral Investig.* 2019; 23(3): 1287-1294.
30. Eden E. Evidence-based caries prevention. C. 1, Evidence-Based Caries Prevention. Switzerland: Springer International Publishing; 2016.
31. Baltacioglu IH, Orhan K. Comparison of diagnostic methods for early interproximal caries detection with near-infrared light transillumination: an in vivo study. *BMC Oral Health*. 2017; 17(1): 2-7.
32. Ozkan G, Guzel KGU. Clinical evaluation of near-infrared light transillumination in approximal dentin caries detection. *Lasers Med Sci.* 2017; 32(6): 1417-1422.
33. Tam LE, McComb D. Diagnosis of occlusal caries: Part II. Recent diagnostic technologies. *J Can Dent Assoc.* 2001; 67(8): 459-463.
34.Yılmaz H, Keleş S. Recent Methods for Diagnosis of Dental Caries in Dentistry. *Meandros Medical and Dental Journal.* 2017; 19(1): 1-8.
35. Yavuz BŞ, Kargül B. Erken çürük lezyonlarının görüntülenmesinde ve değerlendirilmesinde optik koherens tomografi (OCT)'nin kullanımı. *Turkiye Klin Pediatr Dent Top.* 2019; 5(3): 38-44.
36. Yanikoğlu FÇ, Öztürk F, Hayran O, Analoui M, Stookey GK. Detection of natural white spot caries lesions by an ultrasonic system. *Caries Res.* 2000; 34(3): 225-32.
37. Yıldız Ş, Dogan MS, Dogan ME. Evaluation of the reasons for failure in teeth with vital amputation treatment. *BMC Oral Health*. 2023; 23(1), 1-6.