

Bölüm 12

MAKSİLLER SINÜS ELEVASYONU

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GİRİŞ

Paranasal sinüsler yüz ve kafatası kemiğinin içinde bulunan, içi hava ile dolu boşluklardır. Nazal kaviteyi çevreleyecek şekilde dizilen bu boşlukların kafanın ağırlığını hafifletmesi, solunan havayı ısıtması, konuşurken rezonansı arttırması ve bir travma durumunda hayati yapıları koruyacak şekilde deforme olabilmesi gibi özellikleri vardır. Paranasal sinüsler buldukları kemik yapısının ismini alırlar ve 4 farklı kemikte ikişer tane bulunmak üzere toplam 8 tanedirler. Bunlar: Sfenoid, frontal, ethmoidal ve maksiller sinüslerdir.

Maksiller sinüsler ortalama 12,5 ml hacme sahip en geniş paranasal sinüslerdir. Bu yapılar ilk olarak antik Mısır zamanında tanımlanmış ve özellikle yapısı, vasküler anatomisi ve dişlerle olan ilişkileri araştırılmıştır.

Maksiller Sinüs ve Embriyolojisi

Maksiller sinüslerin formasyonu ilk olarak gebeliğin 10. haftasında izlenmektedir. Ethmoid infundibulumun derin ve ön ucunda bulunan mukoza kendisini çevreleyen mezenşime doğru invajinasyonlar gösterir.(1) Gelişimin ilk haftasında bu invajinasyonlar birleşerek primordiyal maksiller sinüsü meydana getirecek şekilde tek bir kavite oluşumunu sağlarlar. Bu oval şekilli ve düzgün duvarlı primordiyal kavite 17. ve 20. haftalarda ve 25. ve 28. haftalar arasında hızlı bir büyümüş gösterir. Maksiller sinüsün kemikleşmesi 16. haftada sinüsün lateral duvarında başlayarak 20. haftada sinüsün anterior duvarına ve 21. haftada da sinüsün posterior duvarına varır. Medial duvarın ossifikasyonu 37. haftada başlamaktadır. Sinüsün tabanı birinci premolar diş hizasına 4 yaş civarında ve ikinci molar diş hizasına da 5 yaş civarında ulaşır. Sinüsün sınırları bazen 3. molar dişe veya kanin dişine kadar da uzayabilmektedir.(1)

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Günümüzde kullanılan bazı macun kıvamındaki greft materyalleri hidrolik basınç sağlayarak hem membran elevasyonu hem de bölgenin greftlenmesini sağlayabilmektedir. Benzer şekilde aynı prensiplerin dayanan piezzo elektrik cerrahi setleri özel geliştirilmiş uçlarla sinüs membranı elevasyonu yapmaya da müsaade etmektedir.

Eitan Mijiritsky ve ark. (77) bir kanal içeren dental implantlar kullanarak bu kanal aracılığıyla hem sinüs tabanını hidrolik basınç kullanarak eleve etmiş hem de bu kanal aracılığıyla akışkan greftler kullanarak bölgeyi greftlemiştir.

KAYNAKLAR

1. Nunez-Castruita A, Lopez-Serna N, Guzman-Lopez S. Prenatal development of the maxillary sinus: a perspective for paranasal sinus surgery. *Otolaryngology and Head and Neck Surgery*. 2012;146(6): 997-1003. doi: 10.1177/0194599811435883
2. Iwanaga J, Wilson C, Lachkar S, et al. Clinical anatomy of the maxillary sinus: application to sinus floor augmentation. *Anatomy & Cell Biology*. 2019;52(1): 17-24. doi: 10.5115/acb.2019.52.1.17
3. Chanavaz M. Maxillary sinus: anatomy, physiology, surgery, and bone grafting related to implantology--eleven years of surgical experience (1979-1990). *Journal of Oral Implantology*. 1990;16(3): 199-209.
4. Eberhardt JA, Torabinejad M, Christiansen EL. A computed tomographic study of the distances between the maxillary sinus floor and the apices of the maxillary posterior teeth. *Oral Surgery, Oral Medicine, Oral Pathology*. 1992;73(3): 345-346. doi: 10.1016/0030-4220(92)90133-b
5. Kilic C, Kamburoglu K, Yuksel SP, et al. An Assessment of the Relationship between the Maxillary Sinus Floor and the Maxillary Posterior Teeth Root Tips Using Dental Cone-beam Computerized Tomography. *European Journal of Dentistry*. 2010;4(4): 462-467.
6. Roque-Torres GD, Ramirez-Sotelo LR, Vaz SL, et al. Association between maxillary sinus pathologies and healthy teeth. *Brazilian Journal of Otorhinolaryngology*. 2016;82(1): 33-38. doi: 10.1016/j.bjorl.2015.11.004
7. Kim MJ, Jung UW, Kim CS, et al. Maxillary sinus septa: prevalence, height, location, and morphology. A reformatted computed tomography scan analysis. *Journal of Periodontology*. 2006;77(5): 903-908. doi: 10.1902/jop.2006.050247
8. Krennmair G, Ulm CW, Lugmayr H, et al. The incidence, location, and height of maxillary sinus septa in the edentulous and dentate maxilla. *Journal of Oral and Maxillofacial Surgery*. 1999;57(6): 667-671; discussion 671-662. doi: 10.1016/s0278-2391(99)90427-5
9. Lee WJ, Lee SJ, Kim HS. Analysis of location and prevalence of maxillary sinus septa. *Journal of Periodontal & Implant Science*. 2010;40(2): 56-60. doi: 10.5051/jpis.2010.40.2.56
10. Maestre-Ferrin L, Carrillo-Garcia C, Galan-Gil S, et al. Prevalence, location, and size of maxillary sinus septa: panoramic radiograph versus computed tomography scan. *Journal of Oral and Maxillofacial Surgery*. 2011;69(2): 507-511. doi: 10.1016/j.joms.2010.10.033
11. Kang SJ, Shin SI, Herr Y, et al. Anatomical structures in the maxillary sinus related to lateral sinus elevation: a cone beam computed tomographic analysis. *Clinical Oral Implants Research*. 2013;24 Suppl A100: 75-81. doi: 10.1111/j.1600-0501.2011.02378.x
12. Velasquez-Plata D, Hovey LR, Peach CC, et al. Maxillary sinus septa: a 3-dimensional computerized tomographic scan analysis. *International Journal of Oral and Maxillofacial Implants*. 2002;17(6): 854-860.

13. Gonzalez-Santana H, Penarrocha-Diago M, Guarinos-Carbo J, et al. A study of the septa in the maxillary sinuses and the subantral alveolar processes in 30 patients. *Journal of Oral Implantology*. 2007;33(6): 340-343. doi: 10.1563/1548-1336(2007)33[340:ASOTSI]2.0.CO;2
14. Lundgren S, Andersson S, Gualini F, et al. Bone reformation with sinus membrane elevation: a new surgical technique for maxillary sinus floor augmentation. *Clinical Implant Dentistry and Related Research*. 2004;6(3): 165-173.
15. Park YB, Jeon HS, Shim JS, et al. Analysis of the anatomy of the maxillary sinus septum using 3-dimensional computed tomography. *Journal of Oral and Maxillofacial Surgery*. 2011;69(4): 1070-1078. doi: 10.1016/j.joms.2010.07.020
16. Bell GW, Joshi BB, Macleod RI. Maxillary sinus disease: diagnosis and treatment. *British Dental Journal*. 2011;210(3): 113-118. doi: 10.1038/sj.bdj.2011.47
17. Chen TW, Chang HS, Leung KW, et al. Implant placement immediately after the lateral approach of the trap door window procedure to create a maxillary sinus lift without bone grafting: a 2-year retrospective evaluation of 47 implants in 33 patients. *Journal of Oral and Maxillofacial Surgery*. 2007;65(11): 2324-2328. doi: 10.1016/j.joms.2007.06.649
18. Gudis DA, Cohen NA. Cilia dysfunction. *Otolaryngologic Clinics of North America*. 2010;43(3): 461-472, vii. doi: 10.1016/j.otc.2010.02.007
19. Kqiku L, Biblekaj R, Weiglein AH, et al. Arterial blood architecture of the maxillary sinus in dentate specimens. *Croatian Medical Journal*. 2013;54(2): 180-184. doi: 10.3325/cmj.2013.54.180
20. Flanagan D. Arterial supply of maxillary sinus and potential for bleeding complication during lateral approach sinus elevation. *Implant Dentistry*. 2005;14(4): 336-338. doi: 10.1097/01.id.0000188437.66363.7c
21. Dursun E, Keceli HG, Dolgun A, et al. Maxillary Sinus and Surrounding Bone Anatomy With Cone Beam Computed Tomography After Multiple Teeth Loss: A Retrospective Multicenter Clinical Study. *Implant Dentistry*. 2019;28(3): 226-236. doi: 10.1097/ID.0000000000000862
22. Lovasova K, Kachlik D, Rozpravkova M, et al. Three-dimensional CAD/CAM imaging of the maxillary sinus in ageing process. *Annals of Anatomy*. 2018;218: 69-82. doi: 10.1016/j.aanat.2018.01.008
23. Gosau M, Rink D, Driemel O, et al. Maxillary sinus anatomy: a cadaveric study with clinical implications. *The Anatomical Record*. 2009;292(3): 352-354. doi: 10.1002/ar.20859
24. Velasco-Torres M, Padiál-Molina M, Avila-Ortiz G, et al. Maxillary Sinus Dimensions Decrease as Age and Tooth Loss Increase. *Implant Dentistry*. 2017;26(2): 288-295. doi: 10.1097/ID.0000000000000551
25. Velasco-Torres M, Padiál-Molina M, Alarcon JA, et al. Maxillary Sinus Dimensions With Respect to the Posterior Superior Alveolar Artery Decrease With Tooth Loss. *Implant Dentistry*. 2016;25(4): 464-470. doi: 10.1097/ID.0000000000000445
26. Jensen O, T. (2006) The sinus bone graft: Quintessence Pub co.
27. Üngör C (2011) Maksiller sinüs augmentasyonunun ses kalitesi üzerine etkisinin akustik analizler ile değerlendirilmesi: Ankara Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara.
28. Dakhli I, Abdelsalam Z, Salem D et al. Validity of tridimensional CT study of maxillary sinus reconstruction in potential implant site. *Cairo Dental Journal*. 2009;25(3): 329-336.
29. Nunes LS, Bornstein MM, Sendi P, et al. Anatomical characteristics and dimensions of edentulous sites in the posterior maxillae of patients referred for implant therapy. *International Journal of Periodontics and Restorative Dentistry*. 2013;33(3): 337-345. doi: 10.11607/prd.1475
30. Dobe I, Kise L, Apse P, et al. Radiographic assessment of findings in the maxillary sinus using cone-beam computed tomography. *Stomatologija*. 2013;15(4): 119-122.
31. Kara IM, Kucuk D, Polat S. Experience of maxillary sinus floor augmentation in the presence of antral pseudocysts. *Journal of Oral and Maxillofacial Surgery*. 2010;68(7): 1646-1650. doi: 10.1016/j.joms.2009.09.116

32. Pommer B, Unger E, Suto D, et al. Mechanical properties of the Schneiderian membrane in vitro. *Clinical Oral Implants Research*. 2009;20(6): 633-637. doi: 10.1111/j.1600-0501.2008.01686.x
33. Khajehahmadi S, Rahpeyma A, Hoseini Zarch SH. Association between the lateral wall thickness of the maxillary sinus and the dental status: cone beam computed tomography evaluation. *Iranian Journal of Radiology*. 2014;11(1): e6675. doi: 10.5812/iranjradiol.6675
34. van den Bergh JP, ten Bruggenkate CM, Disch FJ, et al. Anatomical aspects of sinus floor elevations. *Clinical Oral Implants Research*. 2000;11(3): 256-265. doi: 10.1034/j.1600-0501.2000.011003256.x
35. Greenstein G, Cavallaro J, Tarnow D. Practical application of anatomy for the dental implant surgeon. *Journal of Periodontology*. 2008;79(10): 1833-1846. doi: 10.1902/jop.2008.080086
36. Ewers R. Maxilla sinus grafting with marine algae derived bone forming material: a clinical report of long-term results. *Journal of Oral and Maxillofacial Surgery*. 2005;63(12): 1712-1723. doi: 10.1016/j.joms.2005.08.020
37. Kaufman E. Maxillary sinus elevation surgery: an overview. *Journal of Esthetic and Restorative Dentistry*. 2003;15(5): 272-282; discussion 283. doi: 10.1111/j.1708-8240.2003.tb00298.x
38. Chan HL, Suarez F, Monje A, et al. Evaluation of maxillary sinus width on cone-beam computed tomography for sinus augmentation and new sinus classification based on sinus width. *Clinical Oral Implants Research*. 2014;25(6): 647-652. doi: 10.1111/clr.12055
39. Rahpeyma A, Khajehahmadi S. Open Sinus Lift Surgery and the Importance of Preoperative Cone-Beam Computed Tomography Scan: A Review. *Journal of International Oral Health*. 2015;7(9): 127-133.
40. Cho SC, Wallace SS, Froum SJ, et al. Influence of anatomy on Schneiderian membrane perforations during sinus elevation surgery: three-dimensional analysis. *Practical procedures & aesthetic dentistry*. 2001;13(2): 160-163.
41. Velloso GR, Vidigal GM, Jr., de Freitas MM, et al. Tridimensional analysis of maxillary sinus anatomy related to sinus lift procedure. *Implant Dentistry*. 2006;15(2): 192-196. doi: 10.1097/01.id.0000223233.29454.77
42. Niu L, Wang J, Yu H, et al. New classification of maxillary sinus contours and its relation to sinus floor elevation surgery. *Clinical Implant Dentistry and Related Research*. 2018;20(4): 493-500. doi: 10.1111/cid.12606
43. Wagner F, Dvorak G, Nemeč S, et al. Morphometric analysis of sinus depth in the posterior maxilla and proposal of a novel classification. *Scientific Reports*. 2017;7: 45397. doi: 10.1038/srep45397
44. Teng M, Cheng Q, Liao J, et al. Sinus Width Analysis and New Classification with Clinical Implications for Augmentation. *Clinical Implant Dentistry and Related Research*. 2016;18(1): 89-96. doi: 10.1111/cid.12247
45. Jang HY, Kim HC, Lee SC, et al. Choice of graft material in relation to maxillary sinus width in internal sinus floor augmentation. *Journal of Oral and Maxillofacial Surgery*. 2010;68(8): 1859-1868. doi: 10.1016/j.joms.2009.09.093
46. Avila G, Wang HL, Galindo-Moreno P, et al. The influence of the bucco-palatal distance on sinus augmentation outcomes. *Journal of Periodontology*. 2010;81(7): 1041-1050. doi: 10.1902/jop.2010.090686
47. Lombardi T, Stacchi C, Berton F, et al. Influence of Maxillary Sinus Width on New Bone Formation After Transcrestal Sinus Floor Elevation: A Proof-of-Concept Prospective Cohort Study. *Implant Dentistry*. 2017;26(2): 209-216. doi: 10.1097/ID.0000000000000554
48. Zheng X, Teng M, Zhou F, et al. Influence of Maxillary Sinus Width on Transcrestal Sinus Augmentation Outcomes: Radiographic Evaluation Based on Cone Beam CT. *Clinical Implant Dentistry and Related Research*. 2016;18(2): 292-300. doi: 10.1111/cid.12298

49. Sammartino G, Mariniello M, Scaravilli MS. Benign paroxysmal positional vertigo following closed sinus floor elevation procedure: mallet osteotomes vs. screwable osteotomes. A triple blind randomized controlled trial. *Clinical Oral Implants Research*. 2011;22(6): 669-672. doi: 10.1111/j.1600-0501.2010.01998.x
50. Tetsch J, Tetsch P, Lysek DA. Long-term results after lateral and osteotome technique sinus floor elevation: a retrospective analysis of 2190 implants over a time period of 15 years. *Clinical Oral Implants Research*. 2010;21(5): 497-503. doi: 10.1111/j.1600-0501.2008.01661.x
51. Chiapasco M, Zaniboni M, Rimondini L. Dental implants placed in grafted maxillary sinuses: a retrospective analysis of clinical outcome according to the initial clinical situation and a proposal of defect classification. *Clinical Oral Implants Research*. 2008;19(4): 416-428. doi: 10.1111/j.1600-0501.2007.01489.x
52. Naitoh M, Suenaga Y, Kondo S, et al. Assessment of maxillary sinus septa using cone-beam computed tomography: etiological consideration. *Clinical Implant Dentistry and Related Research*. 2009;11 Suppl 1: e52-58. doi: 10.1111/j.1708-8208.2009.00194.x
53. Shen EC, Fu E, Chiu TJ, et al. Prevalence and location of maxillary sinus septa in the Taiwanese population and relationship to the absence of molars. *Clinical Oral Implants Research*. 2012;23(6): 741-745. doi: 10.1111/j.1600-0501.2011.02195.x
54. Guncu GN, Yildirim YD, Wang HL, et al. Location of posterior superior alveolar artery and evaluation of maxillary sinus anatomy with computerized tomography: a clinical study. *Clinical Oral Implants Research*. 2011;22(10): 1164-1167. doi: 10.1111/j.1600-0501.2010.02071.x
55. Rosano G, Taschieri S, Gaudy JF, et al. Maxillary sinus vascular anatomy and its relation to sinus lift surgery. *Clinical Oral Implants Research*. 2011;22(7): 711-715. doi: 10.1111/j.1600-0501.2010.02045.x
56. Boyne PJ, James RA. Grafting of the maxillary sinus floor with autogenous marrow and bone. *Journal of Oral Surgery*. 1980;38(8): 613-616.
57. Tatum H, Jr. Maxillary and sinus implant reconstructions. *Dental Clinics of North America*. 1986;30(2): 207-229.
58. Hallman M, Thor A. Bone substitutes and growth factors as an alternative/complement to autogenous bone for grafting in implant dentistry. *Periodontology 2000*. 2008;47: 172-192. doi: 10.1111/j.1600-0757.2008.00251.x
59. Triplett RG, Nevins M, Marx RE, et al. Pivotal, randomized, parallel evaluation of recombinant human bone morphogenetic protein-2/absorbable collagen sponge and autogenous bone graft for maxillary sinus floor augmentation. *Journal of Oral and Maxillofacial Surgery*. 2009;67(9): 1947-1960. doi: 10.1016/j.joms.2009.04.085
60. Voss P, Sauerbier S, Wiedmann-Al-Ahmad M, et al. Bone regeneration in sinus lifts: comparing tissue-engineered bone and iliac bone. *British Journal of Oral and Maxillofacial Surgery*. 2010;48(2): 121-126. doi: 10.1016/j.bjoms.2009.04.032
61. Gandhi Y. Sinus Grafts: Science and Techniques-Then and Now. *Journal of Maxillofacial and Oral Surgery*. 2017;16(2): 135-144. doi: 10.1007/s12663-017-1007-x
62. Summers RB. A new concept in maxillary implant surgery: the osteotome technique. *Compendium*. 1994 Feb;15(2):152, 154-6, 158 passim; quiz 162. PMID: 8055503.
63. Riben C, Thor A. The Maxillary Sinus Membrane Elevation Procedure: Augmentation of Bone around Dental Implants without Grafts-A Review of a Surgical Technique. *International Journal of Dentistry*. 2012;2012: 105483. doi: 10.1155/2012/105483
64. Boyne PJ. Analysis of performance of root-form endosseous implants placed in the maxillary sinus. *Journal of Long-Term Effects of Medical Implants*. 1993;3(2): 143-159.
65. Ellegaard B, Kolsen-Petersen J, Baelum V. Implant therapy involving maxillary sinus lift in periodontally compromised patients. *Clinical Oral Implants Research*. 1997;8(4): 305-315. doi: 10.1034/j.1600-0501.1997.080409.x

66. Lundgren S, Andersson S, Sennerby L. Spontaneous bone formation in the maxillary sinus after removal of a cyst: coincidence or consequence? *Clinical Implant Dentistry and Related Research*. 2003;5(2): 78-81. doi: 10.1111/j.1708-8208.2003.tb00187.x
67. Ellegaard B, Baelum V, Kolsen-Petersen J. Non-grafted sinus implants in periodontally compromised patients: a time-to-event analysis. *Clinical Oral Implants Research*. 2006;17(2): 156-164. doi: 10.1111/j.1600-0501.2005.01220.x
68. Thor A, Sennerby L, Hirsch JM, et al. Bone formation at the maxillary sinus floor following simultaneous elevation of the mucosal lining and implant installation without graft material: an evaluation of 20 patients treated with 44 Astra Tech implants. *Journal of Oral and Maxillofacial Surgery*. 2007;65(7 Suppl 1): 64-72. doi: 10.1016/j.joms.2006.10.047
69. Jensen SS, Terheyden H. Bone augmentation procedures in localized defects in the alveolar ridge: clinical results with different bone grafts and bone-substitute materials. *International Journal of Oral and Maxillofacial Implants*. 2009;24 Suppl: 218-236.
70. Del Fabbro M, Testori T, Francetti L, et al. Systematic review of survival rates for implants placed in the grafted maxillary sinus. *International Journal of Periodontics and Restorative Dentistry*. 2004;24(6): 565-577.
71. Felice P, Pistilli R, Piattelli M, et al. 1-stage versus 2-stage lateral sinus lift procedures: 1-year post-loading results of a multicentre randomised controlled trial. *European Journal of Oral Implantology*. 2014;7(1): 65-75.
72. Fugazzotto PA. Immediate implant placement following a modified trephine/osteotome approach: success rates of 116 implants to 4 years in function. *International Journal of Oral and Maxillofacial Implants*. 2002;17(1): 113-120.
73. Cosci F, Luccioli M. A new sinus lift technique in conjunction with placement of 265 implants: a 6-year retrospective study. *Implant Dentistry*. 2000;9(4): 363-368. doi: 10.1097/00008505-200009040-00014
74. Sotirakis EG, Gonshor A. Elevation of the maxillary sinus floor with hydraulic pressure. *Journal of Oral Implantology*. 2005;31(4): 197-204. doi: 10.1563/1548-1336(2005)31[197:EOTMSF]2.0.CO;2
75. Soltan M, Smiler DG. Antral membrane balloon elevation. *Journal of Oral Implantology*. 2005;31(2): 85-90. doi: 10.1563/0-773.1
76. Jesch P, Bruckmoser E, Bayerle A, et al. A pilot-study of a minimally invasive technique to elevate the sinus floor membrane and place graft for augmentation using high hydraulic pressure: 18-month follow-up of 20 cases. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*. 2013;116(3): 293-300. doi: 10.1016/j.oooo.2013.05.014
77. Mijiritsky E, Barbu H, Lorean A, et al. Use of Implant-Derived Minimally Invasive Sinus Floor Elevation: A Multicenter Clinical Observational Study With 12- to 65-Month Follow-Up. *Journal of Oral Implantology*. 2016;42(4): 343-348. doi: 10.1563/aaaid-joi-D-15-00157