BÖLÜM 23

Cerrahi Komplikasyonlar

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GİRİŞ

Yaşlı popülasyonun ve obezite prevelansının artmasıyla dünya genelinde yaklaşık 1 milyar kişide gözlenen Obstrüktif Uyku Apne (OUA) önemli bir halk sağlığı sorunu haline gelmiştir (1). OUA sendromu, uyku sırasında üst solunum yolunun (ÜSY) intermitan ve rekürren parsiyel veya tam kollaps epizodlarıyla seyreden, en sık gözlenen uykuda solunum bozukluğudur (2). Bu epizodlar ÜSY'nda hava akımının azalmasına (hipopne) veya tamamen kesilmesine (apne) yol açar (3). Apne ve hipopne sırasında düşük alveoler ventilasyon PaCO2'da kademeli bir artışla arteriyel kandaki SpO2'nu azaltır. Noktürnal hipoksi ve sistemik inflamasyonlar, kardiyovasküler ve serebrovasküler komorbiditiye neden olur (4). Tedavi edilmezse aşırı gündüz uykululuk haline (somnolans), nörokognitif yetersizliğe, trafik kazalarına, düşük yaşam kalitesine, sağlık ve sosyal maliyetlerin artışına yol açar (5).

Sürekli Pozitif Hava Yolu Basıncı (CPAP), orta ve ağır şiddette OUA tedavisinde ilk tedavi seçeneği olmasına rağmen uzun süreli hasta kabul ve uyumu %50-70 oranındadır (6,7). Yumuşak doku ve iskelet modifikasyon cerrahileri, bariatrik cerrahi, pozisyonel tedavi, hipoglossal sinir stimülasyonu, myofonksiyonel tedavi, karbonik anhidraz inhibitörleri CPAP'a güncel alternatif tedavilerdir (8). 1990'ların başında tanıtılan ilk OUA multilevel cerrahisi olan Faz I cerrahi tedavi, uvulopalatofaringoplasti (UPPP), genioglossus ekspansiyon

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liyetinin yüksek olması dezavantajlarıdır. Güncel literatürde Robo-Cob tekniği dil kökü cerrahisinde kısa operasyon süresi ve düşük postoperatif erken dönem komplikasyon riskiyle popülerlik kazanmıştır.

Yeni uyku cerrahisi tekniklerinin kanıtlarının azlığı ve heterojenliği göz önüne alındığında, bu umut verici sonuçları doğrulamak için multilevel cerrahileri içermeyen, her bir ayrı teknik için daha uzun süre takipli ve daha fazla sayıda hasta içeren randomize kontrollü çalışmalara ihtiyaç vardır.

KAYNAKLAR

1. Benjafield AV, Ayas NT, Eastwood PR, et al. Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-based analysis. Lancet Respir Med. 2019; 7:687–698. Doi: 10.1016/S2213-2600(19)30198-5.
2. Caples SM, Gami AS, Somers VK. Obstructive sleep apnea. Ann Intern Med. 2005; 142:187–97. Doi: 10.7326/0003-4819-142-3-200502010-00010.
3. Veasey SC, Rosen IM. Obstructive Sleep Apnea in Adults. N Engl J Med. 2019; 11: 1442–1449. Doi:10.1056/NEJMc1906527.
4. De Vito A, Woodson BT, Koka V, et al. OSA Upper Airways Surgery: A Targeted Approach. Medicina. 2021; 57: 690. Doi: 10.3390/medicina57070690.
5. Morsy NE, Farrag NS, Zaki NFW, et al. Obstructive sleep apnea: personal, societal, public health, and legal implications. Rev Environ Health. 2019; 34:153–169. Doi: 10.1515/reveh-2018-0068.
6. Lorenzi-Filho G, Almeida FR, Strollo PJ. Treating OSA: Current and emerging therapies beyond CPAP. Respirology. 2017; 22: 1500–1507. Doi: 10.1111/resp.13144.
7. Tingting X, Danming Y, Xin C. Non-surgical treatment of obstructive sleep apnea syndrome. Eur Arch Oto-Rhino-Laryngol. 2018; 275: 335–346. Doi: 10.1007/s00405-017-4818-y.
8. Randerath W, Verbraecken J, de Raaff CAL, et al. European Respiratory Society guideline on non-CPAP therapies for obstructive sleep apnoea. Eur Respir Rev. 2021 30; 30:210200. Doi: 10.1183/16000617.0200-2021.
9. Riley RW, Powell NB, Guilleminault C: Obstructive sleep apnea syndrome: a surgical protocol for dynamic upper airway reconstruction. J Oral Maxillofac Surg. 1993; 51:742–747; discussion 748–749. Doi: 10.1016/s0278-2391(10)80412-4.
10. Friedman M: Sleep Apnea and Snoring. Beijing, Elsevier, 2009.
11. Pang KP, Vicini C, Montevecchi F, et al. Long-term Complications of Palate Surgery: A Multicenter Study of 217 Patients. Laryngoscope. 2020; 130:2281–2284. Doi:10.1002/lary.28432.
12. Amin N, Bhargava E, Prentice JG, et al. Coblation intracapsular tonsillectomy in children: A prospective study of 1257 consecutive cases with long-term follow-up. Clin Otolaryngol. 2021; 46:1184-1192. Doi: 10.1111/coa.13790.
13. Kim J, Poole B, Cen SY, et al. Transoral Robotic Surgery (TORS) Versus Non-TORS Tongue Resection for Obstructive Sleep Apnea. Laryngoscope. 2021; 131: E1735-E1740. Doi:10.1002/lary.29316.
14. Bosi M, De Vito A, Gobbi R, et al. The importance of obstructive sleep apnoea and hypopnea pathophysiology for customized therapy. Eur Arch Oto-Rhino-Laryngol. 2017; 274: 1251–1261. Doi: 10.1007/s00405-016-4223-y.
15. Jordan AS, McSharry DG, Malhotra A. Adult obstructive sleep apnoea. Lancet. 2014; 383:736–747. Doi: 10.1016/S0140-6736(13)60734-5.

16. Osman AM, Carter SG, Carberry JC, et al. Obstructive sleep apnea: Current perspectives. Nat Sci Sleep. 2018; 10: 21–34. Doi: 10.2147/NSS.S124657.
17. Genta PR, Schorr F, Edwards BA, et al. Discriminating the severity of pharyngeal collapsibility in men using anthropometric and polysomnographic indices. J Clin Sleep Med. 2020; 16: 1531–1537. Doi: 10.5664/jcsm.8600.
18. Kim AM, Keenan BT, Jackson N, et al. Tongue fat and its relationship to obstructive sleep apnea. Sleep. 2014; 37:1639–1648. Doi: 10.5665/sleep.4072.
19. Stadler DL, McEvoy RD, Sprecher KE, et al. Abdominal compression increases upper airway collapsibility during sleep in obese male obstructive sleep apnea patients. Sleep. 2009; 32:1579–1587. Doi: 10.1093/sleep/32.12.1579.
20. Bohmer AB, Wappler F. Preoperative evaluation and preparation of the morbidly obese patient. Curr Opin Anaesthesiol. 2017; 30:126-132. Doi: 10.1097/ACO.0000000000000411.
21. Thakker JS, Vuong C, Nguyen K, Inman JC. Epub 2018 Dec 27. Nasal Surgery for Sleep-Disordered Breathing. Atlas Oral Maxillofac Surg Clin North Am. 2019; 27:11-16. Doi: 10.1016/j.cxom.2018.11.009.
22. Yamasaki A, Levesque PA, Lindsay RW. Improvement in Snoring-Related Quality-of-Life Outcomes After Functional Nasal Surgery. Facial Plast Surg Aesthet Med. 2020; 22:25–35. Doi:10.1089/fpsam.2019.29002.
23. Cai Y, Goldberg AN, Chang JL. The Nose and Nasal Breathing in Sleep Apnea. Otolaryngol Clin North Am. 2020; 53: 385-395. Doi: 10.1016/j.otc.2020.02.002.
24. Magliulo G, Iannella G, Ciofalo A, et al. Nasal pathologies in patients with obstructive sleep apnoea. Acta Otorhinolaryngol Ital. 2019; 39:250-256. Doi: 10.14639/0392-100X-2173.
25. Alt JA, DeConde AS, Mace JC, et al. (2015). Quality of Life in Patients With Chronic Rhinosinusitis and Sleep Dysfunction Undergoing Endoscopic Sinus Surgery. JAMA Otolaryngol Head Neck Surg 2015; 141:873-81. Doi: 10.1001/jamaoto.2015.1673.
26. Yalamanchali S, Cipta S, Waxman J, Pott T, Joseph N, Friedman M. Effects of endoscopic sinus surgery and nasal surgery in patients with obstructive sleep apnea. Otolaryngol Head Neck Surg. 2014; 151:171-175. Doi: 10.1177/0194599814528296.
27. Randerath WJ, Verbraecken J, Andreas S, et al. The European Respiratory Society task force on non-CPAP therapies in sleep apnoea. Eur Respir J 2011; 37: 1000-1028. Doi: 10.1183/09031936.00099710.
28. Puccia R, Woodson BT. Palatopharyngoplasty and Palatal Anatomy and Phenotypes for Treatment of Sleep Apnea in the Twenty-first Century. Otolaryngol Clin N Am. 2020; 53: 421–429. Doi: 10.1016/j.otc.2020.02.005.
29. Fujita S, Conway W, Zorick F, Roth T. Surgical correction of anatomic abnormalities in obstructive sleep apnea syndrome: uvulopalatopharyngoplasty. Otolaryngol Head Neck Surg. 1981;89: 923-934. Doi: 10.1177/019459988108900609.
30. Sundaram S, Bridgman SA, Lim J, et al. Surgery for obstructive sleep apnoea. The Cochrane database of systematic reviews. 2005; 4: Cd001004. Doi: 10.1002/14651858.CD001004.pub2.
31. Puccia R, Woodson BT. Palatopharyngoplasty and Palatal Anatomy and Phenotypes for Treatment of Sleep Apnea in the Twenty-first Century. Otolaryngol Clin N Am. 2020; 53: 421–429. Doi: 10.1016/j.otc.2020.02.005.
32. Corradi AMB, Valarelli LP, Grechi TH, et al. Swallowing evaluation after surgery for obstructive sleep apnea syndrome: uvulopalatopharyngoplasty vs. expansion pharyngoplasty. Eur Arch Otorhinolaryngol. 2018; 275:1023-1030. Doi:10.1007/s00405-018-4898-3.
33. Kezirian EJ, Weaver EM, Yueh B, et al. Incidence of serious complications after uvulopalatopharyngoplasty. Laryngoscope. 2004; 114:450-453. Doi: 10.1097/00005537-200403000-00012.

34. Friedman JJ, Salapatas AM, Bonzelaar LB, et al. Changing Rates of Morbidity and Mortality in Obstructive Sleep Apnea Surgery. Otolaryngol Head Neck Surg. 2017; 157:123-127. Doi:10.1177/0194599817706500.
35. Kamami YV: Laser CO2 for snoring: Preliminary results. Acta otorhinolaryngol Belg 1990; 44:451- 456. PMID: 2128762.
36. Walker RP. Surgery of the palate and oropharynx: Laser-assisted techniques. In: Terris D, Goode RL, eds. Sleep apnea and snoring. Florida: Taylor and Francis; 2005:265-276.
37. Friberg D, Gazelius B, Hökfelt T, et al. Abnormal afferent nerve endings in the soft palatal mucosa of sleep apnoics and habitual snorers. Regul Pept. 1997; 71:29–36. Doi: 10.1016/s0167-0115(97)01016-1.
38. Friberg D, Ansved T, Borg K, et al. Histological indications of a progressive snorers disease in an upper airway muscle. Am J Respir Crit Care Med. 1998; 157:586–593. Doi: 10.1164/ajrccm.157.2.96-06049.
39. Camacho M, Nesbitt NB, Lambert E, Laser-Assisted Uvulopalatoplasty for Obstructive Sleep Apnea: A Systematic Review and Meta-Analysis. Sleep. 2017; 40: Doi:10.1093/sleep/zsx004.
40. Littner M, Kushida CA, Hartse K, et al. Practice parameters for the use of laser-assisted uvulopalatoplasty: an update for 2000. Sleep. 2001; 24(5): 603–619.
41. Camacho M, Certal V, Modi R, Capasso R. Tissue-sparing uvulopalatopharyngoplasty for OSA: conservative, compassionate and possibly just as effective. Indian J Otolaryngol Head Neck Surg. 2019;71(1):5–6. Doi:10.1007/s12070-015-0915-7.
42. Powell N, Riley R, Guilleminault C, et al. A reversible uvulopalatal flap for snoring and sleep apnea syndrome. Sleep. 1996; 19:593–599. Doi: 10.1093/sleep/19.7.593.
43. Neruntarat C. Uvulopalatal flap for obstructive sleep apnea: short-term and long-term results. Laryngoscope 2011; 121:683–687. Doi: 10.1002/lary.21157.
44. Cekin E, Cincik H, Ulubil SA, et al. Comparison of uvulopalatopharyngoplasty and uvulopalatal flap in Turkish military personnel with primary snoring. Mil Med. 2009; 174:432-6. Doi: 10.7205/milmed-d-02-0708.
45. Park SK, Lee YS, Kang YA, et al. The effects of uvulopalatal flap operation on speech nasalance and the acoustic parameters of the final nasal consonants. Auris Nasus Larynx. 2018; 45:311–319. Doi: 10.1016/j.anl.2017.06.004.
46. Marcus CL, Moore RH, Rosen CL. A randomized trial of adenotonsillectomy for childhood sleep apnea. N Engl J Med. 2013; 368:2366-2376.
47. Greig SR. Current perspectives on the role of tonsillectomy. J Paediatr Child Health. 2017; 53:1065–1070. Doi:10.1111/jpc.13745.
48. Rodríguez-Catalán J, Fernández-Cantalejo Padial J, Rodríguez Rodríguez P, et al. Postoperative complications after adenotonsillectomy in two paediatric groups: Obstructive sleep apnoea syndrome and recurrent tonsillitis. Acta Otorrinolaringol Esp (Engl Ed). 2020; 71:32-39. Doi: 10.1016/j.otorri.2019.01.002.
49. Julien-Marsollier F, Salis P, Abdat R, et al. Predictive factors of early postoperative respiratory complications after tonsillectomy in children with unidentified risks for this complication. Anaesth Crit Care Pain Med. 2018;37(5):439-445. Doi: 10.1016/j.accpm.2017.09.002.
50. Kim JS, Kwon SH, Lee EJ, et al. Can Intracapsular Tonsillectomy Be an Alternative to Classical Tonsillectomy? A Meta-analysis. Otolaryngol Head Neck Surg. 2017; 157:178–189. Doi:10.1177/0194599817700374.
51. Cavaliere M, De Luca P, De Bonis E, et al. Partial intracapsular tonsillectomy in the treatment of pediatric obstructive sleep apnea/hypopnea syndrome: a prospective study with 5-year follow-up. Eur Arch Otorhinolaryngol. 2022; 279:3089-3093. Doi: 10.1007/s00405-021-07119-3.

52. Bender B, Blassnigg EC, Bechthold J, et al. Microdebriderassisted intracapsular tonsillectomy in adults with chronic or recurrent tonsillitis. Laryngoscope. 2015; 125:2284-2290. Doi: 10.1002/lary.25265.
53. Mukerji SS, Rath S, Zhang WQ, et al. Extracapsular versus intracapsular tonsillectomy: Outcomes in children with a focus on developmental delay. Int J Pediatr Otorhinolaryngol. 2022; 152:110978. doi: 10.1016/j.ijporl.2021.110978.
54. Vicini C, Eesa M, Hendawy E, et al Powered intracapsular tonsillotomy vs. conventional extracapsular tonsillectomy for pediatric OSA: A retrospective study about efficacy, complications and quality of life. Int J Pediatr Otorhinolaryngol.; 79:1106-1110. Doi: 10.1016/j.ijporl.2015.04.041.
55. Hoey AW, Foden NM, Hadjisymeou Andreou S, et al. Coblation® intracapsular tonsillectomy (tonsillotomy) in children: A prospective study of 500 consecutive cases with long-term follow-up. Clin Otolaryngol 2017; 42:1211–1217. Doi:10.1111/coa.12849.
56. Varadharajan K, Caton MN, Faulkner J, et al (2020). Coblation® Intracapsular Tonsillectomy in Children with Recurrent tonsillitis: Initial Experience. Int J Pediatr Otorhinolaryngol 2020; 135:110113. Doi: 10.1016/j.ijporl.2020.1101.
57. Powell NB, Riley RW, Troell RJ, et al. Radiofrequency volumetric tissue reduction of the palate in subjects with sleep-disordered breathing. Chest. 1998; 113: 1163-1174. Doi: 10.1378/chest.113.5.1163.
58. Kezirian EJ, Powell NB, Riley RW, et al. Incidence of complications in radiofrequency treatment of the upper airway. Laryngoscope 2005; 115:1298-1304. Doi: 10.1097/01.MLG.0000165373.78207.BF.
59. Wang X, Liu Y, Tang G, et al. Effects of low-temperature plasma treatment on pulmonary function in children with obstructive sleep apnea-hypopnea syndrome. Ir J Med Sci (1971 -). 2020; 189:603–609. Doi:10.1007/s11845-019-02132-2.
60. Woodson BT, Tadokoro KS, MacKay SG. Radiofrequency ablation of the lateral palatal space for snoring. World J Otorhinolaryngol Head Neck Surg. 2017; 23;3(2):106-109. Doi: 10.1016/j.wjorl.2017.05.005.
61. Amali A, Motiee-Langroudi M, Saedi B, et al. A Comparison of Uvulopalatopharyngoplasty and Modified Radiofrequency Tissue Ablation in Mild to Moderate Obstructive Sleep Apnea: A Randomized Clinical Trial. J Clin Sleep Med. 2017; 13:1089-1096. Doi: 10.5664/jcsm.6730.
62. Lim DJ, Kang SH, Kim BH, et al. Treatment of primary snoring using radiofrequency-assisted uvulopalatoplasty. Eur Arch Otorhinolaryngol. 2007; 264: 761–767. Doi: 10.1007/s00405-007-0252-x.
63. Pang KP, Terris DJ. Modified cautery-assisted palatal stiffening operation: new method for treating snoring and mild obstructive sleep apnea. Otolaryngol Head Neck Surg. 2007;136: 823–826. Doi: 10.1016/j.otohns.2006.11.014.
64. Marzetti A, Tedaldi M, Passali FM. Preliminary findings from our experience in anterior palatoplasty for the treatment of obstructive sleep apnea. Clin Exp Otorhinolaryngol. 2013; 6:18-22. Doi: 10.3342/ceo.2013.6.1.18.
65. Ugur KS, Kurtaran H, Ark N. Comparing anterior palatoplasty and modified uvulopalatopharyngoplasty for primary snoring patients: preliminary results. B-ENT. 2013; 9:285-91. PMID: 24597103.
66. Haytoğlu S, Arikan OK, Muluk NB, et al. Comparison of Anterior Palatoplasty and Uvulopalatal Flap Placement for Treating Mild and Moderate Obstructive Sleep Apnea. Ear Nose Throat J 2018; 97:69–78. Doi:10.1177/014556131809700321.
67. Yüksel E, Mutlu M, Bayır Ö, et al. Comparison of postoperative pain scores and dysphagia between anterior palatoplasty and uvulopalatal flap surgeries. Acta Otolaryngol 2018;

138:1092–1098. Doi:10.1080/00016489.2018.151.
68. Kezirian EJ. Nonresponders to pharyngeal surgery for obstructive sleep apnea: insight from drug-induced sleep endoscopy. Laryngoscope. 2011; 121:1320–1326. Doi: 10.1002/lary.21749.
69. Koutsourelakis I, et al. Surgery for obstructive sleep apnea: sleep endoscopy determinants of outcome. Laryngoscope. 2012; 122:2587- 2591. Doi: 10.1002/lary.23462.
70. Chi JC, Chiang RP, Chou TY, et al. The role of lateral pharyngoplasty in obstructive sleep apnea syndrome. Eur Arch Otorhinolaryngol. 2015; 272:489–496. Doi: 10.1007/s00405-014-3253-6.
71. Vicini C, Meccariello G, Montevecchi F, et al. Effectiveness of barbed repositioning pharyngoplasty for the treatment of obstructive sleep apnea (OSA): A prospective randomized trial. Sleep Breath. 2020; 24:687-694. Doi: 10.1007/s11325-019-01956-7.
72. Dizdar D, Civelek Ş, Çaliş ZA, et al. Comparative Analysis of Lateral Pharyngoplasty and Uvulopalatopharyngoplasty Techniques with Polisomnography and Epworth Sleepiness Scales. J Craniofacial Surg. 2015; 26: 647-651. Doi: 10.1097/SCS.0000000000001979.
73. Pang KP, Woodson BT. Expansion sphincter pharyngoplasty: a new technique for the treatment of obstructive sleep apnea. Otolaryngol Head Neck Surg. 2007; 137:110–114. Doi: 10.1016/j.otohns.2007.03.014.
74. Pang KP, Piccin O, Pang EB, et al. Combined Expansion Pharyngoplasty and Anterior Palatoplasty for the Treatment of OSA. Indian J Otolaryngol Head Neck Surg. 2016; 68:528-33. Doi: 10.1007/s12070-016-1020-2.
75. Plaza G, Baptista P, O'Connor-Reina C, et al. Prospective multi-center study on expansion sphincter pharyngoplasty. Acta Otolaryngol 2019, 219-222. Doi:10.1080/00016489.2018.1533992.
76. Cayir S, Yesildag K, Kayabasi S. Long-term efficacy of expansion sphincter pharyngoplasty in obstructive sleep apnea syndrome. Sleep Breath 2021; 25:1913-1918. Doi:10.1007/s11325-021-02315-1.
77. Dispenza F, Modica D, Gallina S, et al. The Role of Modified Expansion Sphincter Pharyngoplasty in Multilevel Obstructive Sleep Apnea Syndrome Surgery. Int Arch Otorhinolaryngol. 2018, 22(04). Doi:10.1055/s-0038-1648248.
78. Despeghel AS, Mus L, Dick C, et al. Long-term results of a modified expansion sphincter pharyngoplasty for sleep-disordered breathing. Eur Arch Otorhinolaryngol. 2017; 274:1665-1670. Doi: 10.1007/s00405-016-4395-5.
79. Sorrenti G, Piccin O. Functional expansion pharyngoplasty in the treatment of obstructive sleep apnea. Laryngoscope. 2013; 123(11), 2905–2908. Doi:10.1002/lary.23911.
80. Vicini C, Montevecchi F, Pang K, et al. Combined transoral robotic tongue base surgery and palate surgery in obstructive sleep apnea-hypopnea syndrome: Expansion sphincter pharyngoplasty versus uvulopalatopharyngoplasty. Head Neck. 2013; 36:77–83. Doi:10.1002/hed.23271.
81. Sorrenti G, Piccin O. Functional expansion pharyngoplasty in the treatment of obstructive sleep apnea. Laryngoscope. 2013; 12:2905–2908. Doi:10.1002/lary.23911.
82. Ulualp SO. Modifed expansion sphincter pharyngoplasty for treatment of children with obstructive sleep apnea. JAMA Otolaryngol Head Neck Surg. 2014; 140:817–822. Doi: 10.1001/jamaoto.2014.1329.
83. Pang KP, Pang EB, Win MT, et al. Expansion sphincter pharyngoplasty for the treatment of OSA: a systemic review and meta -analysis. Eur Arch Otorhinolaryngol. 2016; 273:2329-33. Doi: 10.1007/s00405-015-3831-2.
84. Moffa A, Rinaldi V, Mantovani M, et al. Different barbed pharyngoplasty techniques for retropalatal collapse in obstructive sleep apnea patients: a systematic review. Sleep Breath. 2020; 24:1115-1127. Doi: 10.1007/s11325-020-02088-z.

85. Li HY, Lee LA. Relocation pharyngoplasty for obstructive sleep apnea. Laryngoscope. 2009; 119:2472–2477. Doi: 10.1002/lary.20634.
86. Vicini C, Hendawy E, Campanini A, et al. Barbed reposition pharyngoplasty (BRP) for OSAHS: a feasibility, safety, efficacy and teachability pilot study. "We are on the giant's shoulders". Eur Arch Otorhinolaryngol. 2015; 272:3065-3070. Doi: 10.1007/s00405-015-3628-3.
87. Salamanca F, Costantini F, Mantovani M et al. Barbed anterior pharyngoplasty: an evolution of anterior palatoplasty. Acta Otorhinolaryngol Ital. 2014; 34:434–438. PMID: 25762837.
88. Vicini C, Meccariello G, Cammaroto G, et al. Barbed reposition pharyngoplasty in multilevel robotic surgery for obstructive sleep apnoea. Acta Otorhinolaryngol Ital. 2017; 37:214–217. Doi: 10.14639/0392-100X-1203.
89. Montevecchi F, Meccariello G, Firinu E, et al. Prospective multicentre study on barbed reposition pharyngoplasty standing alone or as a part of multilevel surgery for sleep apnoea. Clin Otolaryngol. 2018; 43:483–488. Doi: 10.1111/coa.13001.
90. Iannella G, Magliulo G, Di Luca M, et al. Lateral pharyngoplasty techniques for obstructive sleep apnea syndrome: a comparative experimental stress test of two different techniques. Eur Arch Otorhinolaryngol 2020; 277:1793-1800. Doi:10.1007/s00405-020-05883-2.
91. Tsou YA, Hsu CC, Shih LC, et al. Swallowing evaluation after surgery for obstructive sleep apnea syndrome: uvulopalatopharyngoplasty vs. expansion pharyngoplasty. J Clin Med. 2021; 10(14):3169. Doi: 10.3390/jcm10143169.
92. Rashwan MS, Montevecchi F, Cammaroto G, et al. Evolution of soft palate surgery techniques for obstructive sleep apnea patients: A comparative study for single-level palatal surgeries. Clin Otolaryngol. 2018; 43: 584–590. Doi: 10.1111/coa.13027.
93. Cammaroto G, Montevecchi F, D'Agostino G, et al. Palatal surgery in a transoral robotic setting (TORS): preliminary results of a retrospective comparison between uvulopalatopharyngoplasty (UPPP), expansion sphincter pharyngoplasty (ESP) and barbed repositioning pharyngoplasty (BRP). Acta Otorhinolaryngol Italy. 2017; 37(5):406-409. Doi: 10.14639/0392-100X-1321.
94. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep. 1991; 14:540–545. Doi: 10.1093/sleep/14.6.540.
95. Spanish Group of Breathing Sleep Disorders, Masa JF, Jiménez A, et al. Visual analogical well-being scale for sleep apnea patients validity and responsiveness a test for clinical practice. Sleep Breath Schlaf Atm. 2011; 15:549–559. Doi: 10.1007/ s11325-010-0399-3 26.
96. Martínez-Ruíz de Apodaca P, Carrasco-Llatas M, Matarredona-Quiles S, et al. Long-term stability of results following surgery for obstructive sleep apnea (OSA). Eur Arch Otorhinolaryngol. 2022; 279:373-380. Doi: 10.1007/s00405-021-06781-x.
97. Cammaroto G, Montevecchi F, D'Agostino G, et al. Tongue reduction for OSAHS: TORSs vs coblations, technologies vs techniques, apples vs oranges. Eur Arch Otorhinolaryngol. 2017; 274:637-645. Doi: 10.1007/s00405-016-4112-4.
98. Martínez Ruiz de Apodaca P, Carrasco Llatas M, Valenzuela Gras M, Dalmau Galofre J. Improving surgical results in velopharyngeal surgery: our experience in the last decade. Acta Otorrinolaringol Esp 2020;71: 197–203. Doi: 10.1016/j.otorri.2019.06.001.
99. Kezirian EJ, Maselli J, Vittinghoff E, et al. Obstructive sleep apnea surgery practice patterns in the United States: 2000 to 2006. Otolaryngol Head Neck Surg. 2010; 143:441-447. Doi: 10.1016/j.otohns.2010.05.009.
100. O'Malley BW Jr, Weinstein GS, Snyder W, et al. Transoral robotic surgery (TORS) for base of tongue neoplasms. Laryngoscope. 2006; 116:1465–1472. Doi: 10.1097/01.mlg.0000227184.90514.1a.
101. Paker M, Duek I, Awwad F, et al. Long-term swallowing performance following transoral

robotic surgery for obstructive sleep apnea. Laryngoscope. 2018. Doi:10.1002/lary.27364.
102. Aynacı E, Karaman M, Kerşin B, et al. Comparison of radiofrequency and transoral robotic surgery in obstructive sleep apnea syndrome treatment. Acta Otolaryngol. 2018; 138:502-506. Doi: 10.1080/00016489.2017.1417635.
103. Hwang CS, Kim JW, Kim JW, et al. Comparison of robotic and coblation tongue base resection for obstructive sleep apnoea. Clin Otolaryngol. 2018; 43:249-255. Doi: 10.1111/coa.12951.
104. Lan WC, Chang WD, Tsai MH, et al. Trans-oral robotic surgery versus coblation tongue base reduction for obstructive sleep apnea syndrome. PeerJ. 2019; 7:7812. Doi: 10.7717/peerj.7812.
105. Huang HH, Tsao CH, Wei JC. Voice Assessment in Patients With Obstructive Sleep Apnea Syndrome After Transoral Robotic Surgery. Front Surg. 2021; 8:647792. Doi: 10.3389/fsurg.2021.647792.
106. Lin HC ve Friedman M. Transoral Robotic Surgery. Auris Nasus Larynx. 2021; 48(3):339-346. doi: 10.1016/j.anl.2020.08.025.
107. Cohen DS, Low GM, Melkane AE, et al. Establishing a danger zone: an anatomic study of the lingual artery in base of tongue surgery. Laryngoscope 2017; 127:110–115. Doi: 10.1002/lary.26048.
108. Justin GA, Chang ET, Camacho M, et al. Transoral robotic surgery for obstructive sleep apnea: a systematic review and meta-analysis. Otolaryngol Head Neck Surg. 2016; 154:835–846. Doi: 10.1177/0194599816630962.
109. Chang CC, Wu JL, Hsiao JR, et al. Real-Time, Intraoperative, Ultrasound-Assisted Transoral Robotic Surgery for Obstructive Sleep Apnea. Laryngoscope. 2021; 131:1383-1390. Doi: 10.1002/lary.29135.
110. Bahgat A, Bahgat Y, Alzahrani R, et al. Transoral Endoscopic Coblation Tongue Base Surgery in Obstructive Sleep Apnea: Resection versus Ablation. ORL J Otorhinolaryngol Relat Spec. 2020; 82:201-208. Doi: 10.1159/000506994.
111. Camacho M, Certal V, Brietzke SE, et al. Tracheostomy as Treatment for Adult Obstructive Sleep Apnea. Laryngoscope. 2013; 124:803–811. Doi:10.1002/lary. 24433.
112. Halle TR, Oh MS, Collop NA, et al. Surgical Treatment of OSA on Cardiovascular Outcomes: A Systematic Review. Chest. 2017; 152:1214-1229. Doi: 10.1016/j.chest.2017.09.004.
113. Conway WA, Victor LD, Magilligan DJ Jr, et al. Adverse effects of tracheostomy for sleep apnea. JAMA. 1981; 246:347–350. PMID: 7241781.
114. Woodson BT. Sleep Medicine and Surgery. In: James B. Snow, P. Ashley Wackym, ed. Ballenger's Otolaryngology, Head and Neck Surgery, centennial ed. Newyork: People's Medical Publishing House. BC Decker Inc.2009: 983-6.
115. Toh S-T, Hsu P-P, Tan KLA, et al. Hyoid expansion with titanium plate and screw: a human cadaveric study using computer-assisted airway measurement. JAMA Otolaryngol Head Neck Surg. 2013; 139:817-821. Doi:10.1001/jamaoto.2013.3906.
116. Hamans E, Stuck BA, de Vries N, et al. Hyoid expansion as a treatment for obstructive sleep apnea: a pilot study. Sleep Breath. 2013; 17: 195-201. Doi:10.1007/s11325-012-0673-7.
117. Kato MG, Isaac MJ, Gillespie MB, et al. The Incidence and Characterization of Globus Sensation, Dysphagia, and Odynophagia Following Surgery for Obstructive Sleep Apnea. J Clin Sleep Med. 2018; 14:127-132. Doi: 10.5664/jcsm.6898.
118. Cheng A. Genioglossus and Genioplasty Advancement. Atlas Oral Maxillofac Surg Clin North Am. 2019; 27:23-28. Doi: 10.1016/j.cxom.2018.11.008.
119. Rojas R, Chateau R, Gaete C, et al. Genioglossus muscle advancement and simultaneous sliding genioplasty in the management of sleep apnoea. Int J Oral Maxillofac Surg. 2016; 47:638–641. Doi: 10.1016/j.ijom.2017.10.008.

120. Song SA, Chang ET, Certal V, et al. Genial tubercle advancement and genioplasty for obstructive sleep apnea: a systematic review and meta-analysis. Laryngoscope. 2017; 127: 984-992. Doi:10.1002/ lary.26218.
121. Cistulli PA, Palmisano RG, Poole MD. Treatment of obstructive sleep apnea syndrome by rapid maxillary expansion. Sleep. 1998; 21:831-835. Doi: 10.1093/sleep/21.8.831.
122. Pirelli P, Saponara M, Attanasio G. Obstructive sleep apnoea syndrome (OSAS) and rhino-tubaric disfunction in children: therapeutic effects of RME therapy. Prog Orthod. 2005; 6:48–61. PMID: 15891784.
123. Camacho M, Certal V, Capasso R. Comprehensive review of surgeries for obstructive sleep apnea syndrome. Braz J Otorhinolaryngol. 2013; 79: 780-788. Doi:10.5935/1808-8694.20130139.
124. Abdullatif J, Certal V, Zaghi S, et al: Maxillary expansion and maxillomandibular expansion for adult OSA: a systematic review and meta-analysis. J Cranio-Maxillofacial Surg. 2016; 44(5): 574-578. Doi: 10.1016/j.jcms.2016.02.001.
125. Liu SY-C, Huon L-K, Iwasaki T. Efficacy of maxillomandibular advancement examined with drug-induced sleep endoscopy and computational fluid dynamics airflow modeling. Otolaryngol Head Neck Surg. 2016; 154:189–195. Doi:10.1177/0194599815611603.
126. Chang KK, Kim KB, McQuilling MW, et al. Fluid structure interaction simulations of the upper airway in obstructive sleep apnea patients before and after maxillomandibular advancement surgery. Am J Orthod Dentofac Orthop. 2018; 153: 895–904. Doi: 10.1016/j.ajodo.2017.08.027.
127. Liu SY-C, Huon L-K, Powell NB, 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. J Oral Maxillofac Surg. 2015; 73:1575–1582. Doi: 10.1016/j.joms.2015.01.028.
128. John CR, Gandhi S, Sakharia AR, et al. Maxillomandibular advancement is a successful treatment for obstructive sleep apnoea: a systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2018; 47(12):1561-1571. Doi: 10.1016/j.ijom.2018.05.015.
129. Randerath W, Verbraecken J, de Raaff CAL, et al. European Respiratory Society guideline on non-CPAP therapies for obstructive sleep apnoea. Eur Respir Rev. 2021 30; 30:210200. Doi: 10.1183/16000617.0200-2021.
130. Awad M, Gouveia C, Zaghi S, et al. Changing practice: Trends in skeletal surgery for obstructive sleep apnea. Craniomaxillofac Surg. 2019; 47:1185-1189. Doi: 10.1016/j.jcms.2018.11.005.