

## Bölüm 5

# TEMPOROMANDİBULAR EKLEM RAHATSIZLIKLARINDA MİNİMAL İNVAZİV TEDAVİ YÖNTEMLERİ

Ümmügülsüm COŞKUN<sup>1</sup>

### Temporomandibular Eklem Rahatsızlıkları ve Tedavisi

Temporomandibular eklem (TME), fibröz bir kapsül ile çevrili temporal kemiğin artiküler yüzeyi ve mandibula kondil başından oluşan ginglymoartrodial bir eklemdir. TME rahatsızlıkları TME'nin ve çiğneme kaslarının ağrı ve fonksiyon kaybına neden olan hastalıkların ortak adıdır. TME bozukluklarının çene fonksiyonu üzerinde olumsuz etkisi vardır. Bu nedenle hastalar ağrı ve sınırlı ağız açıklığı veya kilitlenme nedeniyle çiğneme fonksiyonunu yerine getiremezler (1). Genel nüfus popülasyonunun yaklaşık %60-70'i TME bozukluklarının en az bir belirtisini göstermekle beraber bu belirtilere sahip kişilerin sadece dörtte biri bu semptomun veya semptomların farkındadır. TME rahatsızlıkları her yaşta görülebilmekle beraber erken yetişkinlik döneminde daha fazla görülmektedir. Ayrıca kadınlarda erkeklere oranla 4 kat daha fazla karşılaşılmaktadır (1,2).

En yaygın üç TME bozukluğu; miyofasiyal ağrı ve disfonksiyon, internal düzensizlikler ve osteoartrozdur (3). Miyofasiyal ağrı ve disfonksiyon en yaygın olanıdır (4,5). İnternal düzensizlikler ise çene hareketlerinde kısıtlanma veya mandibular dislokasyona neden olabilecek seviyede hipermobilité ile sonuçlanan artiküler diskin anormal pozisyonu olarak tanımlanmaktadır (1). Osteoartroz ise, esas olarak TME'nin mandibular kondilinin eklem kıkırdağını etkileyen lokalize dejeneratif bir hastalıktır ve sıklıkla yaşlı bireylerde görülür, ancak nadiren de olsa genç hastalarda da ortaya çıkabilmektedir (6).

TME rahatsızlıklarının tedavi seçenekleri; non-invaziv, minimal invaziv ve invaziv veya cerrahi yaklaşımdır (7,8). Non-invaziv tedavi yöntemleri TME rahatsızlıklarının tedavisinde ilk seçenek olarak tavsiye edilmektedir (9). TME rahatsızlığı olan hastaların %90'ı non-invaziv tedavi ile etkili bir şekilde tedavi edilebilmektedir (2). Non-invaziv tedavi seçenekleri; farmakolojik tedavi, hasta eğitimi, düzenli takip, fizyoterapi, okluzal splintler, lazer ve akupunkturdan oluşmaktadır (1,10).

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daha yüksek oranda bulunmakta olup uzamış büyüme faktörü ve sitokin salınımı elde edilmektedir (132,133)

Torul ve ark. (130) yaptıkları çalışmada Wilkes evre III hastalarında sadece artrosentez, artrosentez sonrası HA ve enjekte edilebilir TZF'nin etkinliğini değerlendirmişlerdir. Çalışmada ağrı ve maksimum ağız açıklığı değerlendirilirken, artrosentez sonrası uygulanan enjekte edilebilir TZF'nin sadece artrosentez ve artrosentez ve HA uygulanan gruplardan daha etkili olduğu belirtilmiştir. Albilia ve ark. (132) ise yapmış oldukları çalışmada Wilkes evre 1-5 hastalarına intraartiküler TZF enjekte ederek TZF'nin özellikle ileri evre Wilkes hastalarında uzun dönem analjezik etki sağladığını belirtmişlerdir.

Yuce ve Komerik (134) çalışmalarında, TME disfonksiyonu ve ağrısı olan hastalarda sadece artrosentez, artrosentez ve HA ve artrosentez ve enjekte edilebilir TZF'nin etkisini değerlendirmişlerdir. Çalışmada TZF enjekte edilen grupta ağrı da azalma ve maksimum ağız açıklığı anlamlı derecede diğer gruplardan yüksek bulunmuştur.

Enjekte edilebilir TZF ve TME rahatsızlıklarının kullanımı ile ilgili yapılan çalışmalar doğrultusunda, TME rahatsızlıklarında disfonksiyon ve ağrının tedavi edilmesinde TZF oldukça başarılı olmaktadır. Bu nedenle TME rahatsızlıklarının tedavisinde enjekte edilebilir TZF etkili ve güvenli bir tedavi alternatifi olmaktadır (130,132,134).

## KAYNAKLAR

1. Dimitroulis G. Management of temporomandibular joint disorders: A surgeon's perspective. *Australian Dental Journal*. 2018;63:79–90. doi: 10.1111/adj.12593.
2. Dimitroulis G. Fortnightly review: Temporomandibular disorders: a clinical update. *British medical journal*. 1998;317(7152):190–4. doi: 10.1136/bmj.317.7152.190.
3. Dimitroulis G. Temporomandibular joint surgery: what does it mean to the dental practitioner? *Australian Dental Journal*. 2011;56(3):257–64. doi: 10.1111/j.1834-7819.2011.01351.x.
4. Ghurye S, McMillan R. Pain-related temporomandibular disorder – current perspectives and evidence-based management. *Dental Update*. 2015;42(6):533–46. doi: 10.12968/denu.2015.42.6.533.
5. Roldán-Barraza C, Janko S, Villanueva J, et al. A Systematic Review and Meta-analysis of Usual Treatment Versus Psychosocial Interventions in the Treatment of Myofascial Temporomandibular Disorder Pain. *Journal of Oral & Facial Pain and Headache*. 2014;28(3):205–22. doi: 10.11607/ofph.1241.
6. Mercuri LG. Osteoarthritis, Osteoarthrosis, and Idiopathic Condylar Resorption. *Oral and Maxillofacial Surgery Clinics of North America*. 2008;20(2):169–83. doi: 10.1016/j.coms.2007.12.007.
7. Tanaka E, Detamore MS, Mercuri LG. Degenerative Disorders of the Temporomandibular Joint: Etiology, Diagnosis, and Treatment. *Journal of Dental Research*. 2008;87(4):296–307. doi: 10.1177/154405910808700406.

8. Mercuri LG. Osteoarthritis, Osteoarthrosis, and Idiopathic Condylar Resorption. *Oral and Maxillofacial Surgery Clinics of North America*. 2008;20(2):169–83. doi: 10.1016/j.coms.2007.12.007.
9. de Souza RF, Lovato da Silva CH, Nasser M, et al. *Interventions for managing temporomandibular joint osteoarthritis*. Cochrane Database of Systematic Reviews. 2012 Apr 18. doi: 10.1002/14651858.CD007261.pub2.
10. Kalladka M, Quek S, Heir G, et al. Temporomandibular Joint Osteoarthritis: Diagnosis and Long-Term Conservative Management: A Topic Review. *The Journal of Indian Prosthodontic Society*. 2014 Mar 22;14(1):6–15. doi: 10.1007/s13191-013-0321-3.
11. Monje-Gil F, Nitzan D, Gonzalez-Garcia R. Temporomandibular joint arthrocentesis. Review of the literature. *Medicina Oral Patología Oral y Cirugía Bucal*. 2012;17(4):575–81. doi: 10.4317/medoral.17670.
12. Barkin S, Weinberg S. Internal derangements of the temporomandibular joint: the role of arthroscopic surgery and arthrocentesis. *Journal Canadian Dental Association*. 2000;66(4):199–203.
13. Machado E, Bonotto D, Cunali PA. Intra-articular injections with corticosteroids and sodium hyaluronate for treating temporomandibular joint disorders: a systematic review. *Dental Press Journal of Orthodontics*. 2013 Oct;18(5):128–33. doi: 10.1590/s2176-94512013000500021.
14. Dimitroulis G. The role of surgery in the management of disorders of the Temporomandibular Joint: a critical review of the literature Part 1. *International Journal of Oral and Maxillofacial Surgery*. 2005;34(2):107–13. doi: 10.1016/j.ijom.2004.06.011.
15. Sidebottom A, Murakami K. Arthrocentesis and Arthroscopic Management of the Temporomandibular Joint. In: Peter Brennan, Henning Schliephake, G.E. Ghali, Luke Cascarini (eds) *Maxillofacial Surgery*. London: Churchill Livingstone; 2017. p. 1473–9.
16. Önder ME, Tüz HH, Koçyiğit D, et al. Long-term results of arthrocentesis in degenerative temporomandibular disorders. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2009;107(1):1–5. doi: 10.1016/j.tripleo.2008.08.015.
17. Nitzan DW, Franklin Dolwick M, Martinez GA. Temporomandibular joint arthrocentesis: A simplified treatment for severe, limited mouth opening. *Journal of Oral and Maxillofacial Surgery*. 1991;49(11):1163–7. doi: 10.1016/0278-2391(91)90409-f.
18. Nitzan DW, Price A. The use of arthrocentesis for the treatment of osteoarthritic temporomandibular joints. *Journal of Oral and Maxillofacial Surgery*. 2001 Oct;59(10):1154–9. doi: 10.1053/joms.2001.26716.
19. Monje-Gil F, Nitzan D, Gonzalez-Garcia R. Temporomandibular joint arthrocentesis. Review of the literature. *Medicina Oral Patología Oral y Cirugía Bucal*. 2012;575–81. doi: 10.4317/medoral.17670.
20. Tvrdy P, Heinz P, Pink R. Arthrocentesis of the temporomandibular joint: A review. *Biomedical Papers*. 2015 Mar 9;159(1):031–4. doi: 10.5507/bp.2013.026.
21. Guarda-Nardini L, Manfredini D, Ferronato G. Arthrocentesis of the temporomandibular joint: a proposal for a single-needle technique. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2008 Oct;106(4):483–6. doi: 10.1016/j.tripleo.2007.12.006.
22. Laskin DM. Needle placement for arthrocentesis. *Journal of Oral and Maxillofacial Surgery*. 1998;56(7):907. doi: 10.1016/s0278-2391(98)90043-x.
23. Rahal A, Poirier J, Ahmarani C. Single-Puncture Arthrocentesis—Introducing a New Technique and a Novel Device. *Journal of Oral and Maxillofacial Surgery*. 2009;67(8):1771–3. doi: 10.1016/j.joms.2009.04.006.
24. Alkan A, Etöz OA. A new anatomical landmark to simplify temporomandibular joint arthrocentesis. *British Journal of Oral and Maxillofacial Surgery*. 2010;48(4):310–1. doi: 10.1016/j.bjoms.2009.06.020.

25. Zardeneta G, Milam SB, Schmitz JP. Elution of proteins by continuous temporomandibular joint arthrocentesis. *Journal of Oral and Maxillofacial Surgery*. 1997;55(7):709–16. doi: 10.1016/s0278-2391(97)90583-8.
26. Kaneyama K, Segami N, Nishimura M, et al. The ideal lavage volume for removing bradykinin, interleukin-6, and protein from the temporomandibular joint by arthrocentesis. *Journal of Oral and Maxillofacial Surgery*. 2004;62(6):657–61. . doi: 10.1016/j.joms.2003.08.031.
27. Tozoglu S, Al-Belasy FA, Dolwick MF. A review of techniques of lysis and lavage of the TMJ. *British Journal of Oral and Maxillofacial Surgery*. 2011;49(4):302–9. doi: 10.1016/j.joms.2010.03.008.
28. Shinjo H, Nakata K, Shino K, et al. Effect of irrigation solutions for arthroscopic surgery on intra-articular tissue: Comparison in human meniscus-derived primary cell culture between lactate Ringer's solution and saline solution. *Journal of Orthopaedic Research*. 2002 Nov;20(6):1305–10. doi: 10.1016/S0736-0266(02)00062-1.
29. Frost DE, Kendell BD. The use of arthrocentesis for treatment of temporomandibular joint disorders. *Journal of Oral and Maxillofacial Surgery*. 1999;57(5):583–7. doi: 10.1016/s0278-2391(99)90080-0.
30. Greene CS. The etiology of temporomandibular disorders: implications for treatment. *Journal of orofacial pain*. 2001;15(2):93–105.
31. Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. *Journal of orofacial pain*. 1999;13(4):232–7.
32. Dimitroulis G. Management of temporomandibular joint disorders: A surgeon's perspective. *Australian Dental Journal*. 2018;63:S79–90. doi: 10.1111/adj.12593.
33. McCain JP, de la Rúa H. Arthroscopic observation and treatment of synovial chondromatosis of the temporomandibular joint. *International Journal of Oral and Maxillofacial Surgery*. 1989;18(4):233–6. doi: 10.1016/s0901-5027(89)80060-8.
34. Segami N, Kaneyama K, Tsurusako S, et al. Arthroscopic eminoplasty for habitual dislocation of the temporomandibular joint: preliminary study. *Journal of Cranio-Maxillofacial Surgery*. 1999;27(6):390–7. doi: 10.1054/jcms.2000.0086.
35. Sembronio S, Albiero AM, Toro C, et al. Arthroscopy with open surgery for treatment of synovial chondromatosis of the temporomandibular joint. *British Journal of Oral and Maxillofacial Surgery*. 2008;46(7):582–4. doi: 10.1016/j.joms.2008.01.009.
36. Moses JJ, Sartoris D, Glass R, et al. The effect of arthroscopic surgical lysis and lavage of the superior joint space on TMJ disc position and mobility. *Journal of Oral and Maxillofacial Surgery*. 1989;47(7):674–8. doi: 10.1016/s0278-2391(89)80004-7.
37. Montgomery MT, van Sickels JE, Harms SE, et al. Arthroscopic TMJ surgery: Effects on signs, symptoms, and disc position. *Journal of Oral and Maxillofacial Surgery*. 1989;47(12):1263–71. doi: 10.1016/0278-2391(89)90721-0.
38. McCain JP, Sanders B, Koslin MG, et al. Temporomandibular joint arthroscopy: A 6-year multicenter retrospective study of 4,831 joints. *Journal of Oral and Maxillofacial Surgery*. 1992;50(9):926–30. doi: 10.1016/0278-2391(92)90047-4.
39. Murakami K, Segami N, Okamoto M, et al. Outcome of arthroscopic surgery for internal derangement of the temporomandibular joint: long-term results covering 10 years. *Journal of Cranio-Maxillofacial Surgery*. 2000;28(5):264–71. doi: 10.1054/jcms.2000.0162.
40. Sorel B, Piecuch JF. Long-term evaluation following temporomandibular joint arthroscopy with lysis and lavage. *International Journal of Oral and Maxillofacial Surgery*. 2000 Aug;29(4):259–63. doi:10.1016/S0901-5027(00)80024-7.
41. Sanders B. Arthroscopic surgery of the temporomandibular joint: Treatment of internal derangement with persistent closed lock. *Oral Surgery, Oral Medicine, Oral Pathology*. 1986;62(4):361–doi: 10.1016/0030-4220(86)90282-3.

42. Yang C, Cai X-Y, Chen M-J, et al. New arthroscopic disc repositioning and suturing technique for treating an anteriorly displaced disc of the temporomandibular joint: part I – technique introduction. *International Journal of Oral and Maxillofacial Surgery*. 2012 Sep;41(9):1058–63. doi: 10.1016/j.ijom.2012.05.025.
43. McCain JP, Hossameldin RH, Srouji S, et al. Arthroscopic Discopexy Is Effective in Managing Temporomandibular Joint Internal Derangement in Patients With Wilkes Stage II and III. *Journal of Oral and Maxillofacial Surgery*. 2015;73(3):391–401. doi: 10.1016/j.joms.2014.09.004.
44. Sembronio S, Albiero AM, Toro C, et al. Arthroscopy with open surgery for treatment of synovial chondromatosis of the temporomandibular joint. *British Journal of Oral and Maxillofacial Surgery*. 2008;46(7):582–4. doi: 10.1016/j.bjoms.2008.01.009.
45. Cai X-Y, Yang C, Chen M-J, et al. Arthroscopic Management for Synovial Chondromatosis of the Temporomandibular Joint: A Retrospective Review of 33 Cases. *Journal of Oral and Maxillofacial Surgery*. 2012;70(9):2106–13. doi: 10.1016/j.joms.2011.09.043.
46. Ybema A, de Bont LGM, Spijkervet FKL. Arthroscopic cauterization of retrodiscal tissue as a successful minimal invasive therapy in habitual temporomandibular joint luxation. *International Journal of Oral and Maxillofacial Surgery*. 2013;42(3):376–9. doi: 10.1016/j.ijom.2012.09.017.
47. Sato J, Segami N, Nishimura M, et al. Clinical evaluation of arthroscopic eminoplasty for habitual dislocation of the temporomandibular joint: Comparative study with conventional open eminectomy. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2003;95(4):390–5. doi: 10.1067/moe.2003.128.
48. Shinohara E, Pardo-Kaba S, Martini M, et al. Single puncture for TMJ arthrocentesis: An effective technique for hydraulic distention of the superior joint space. *National Journal of Maxillofacial Surgery*. 2012;3(1):96. doi: 10.4103/0975-5950.102177.
49. Emshoff R, Puffer P, Rudisch A, Gassner R. Temporomandibular joint pain: Relationship to internal derangement type, osteoarthritis, and synovial fluid mediator level of tumor necrosis factor- $\alpha$ . *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2000;90(4):442–9. doi: 10.1067/moe.2000.108801.
50. Stegenga B. Temporomandibular joint degenerative disease: clinical diagnosis. In: Boudewijn Stegenga Lambert G. M. de Bont (eds). *Management of temporomandibular joint degenerative diseases*. Birkhäuser Basel; 1996. p. 9–18.
51. Sembronio S, Albiero AM, Toro C, et al. Is there a role for arthrocentesis in recapturing the displaced disc in patients with closed lock of the temporomandibular joint? *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2008 Mar;105(3):274–80. doi: 10.1016/j.tripleo.2007.07.003.
52. Emshoff R, Puffer P, Strobl H, et al. Effect of temporomandibular joint arthrocentesis on synovial fluid mediator level of tumor necrosis factor-alpha: implications for treatment outcome. *International journal of oral and maxillofacial surgery*. 2000;29(3):176–82. doi:10.1016/S0901-5027(00)80088-0.
53. Hosaka H, Murakami K, Goto K, et al. Outcome of arthrocentesis for temporomandibular joint with closed lock at 3 years follow-up. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 1996;82(5):501–4. doi:10.1016/s1079-2104(96)80193-4.
54. Schiffman EL, Look JO, Hodges JS, et al. Randomized Effectiveness Study of Four Therapeutic Strategies for TMJ Closed Lock. *Journal of Dental Research*. 2007;86(1):58–63. doi: 10.1177/154405910708600109.
55. Al-Baghdadi M, Durham J, Araujo-Soares V, et al. TMJ Disc Displacement without Reduction Management. *Journal of Dental Research*. 2014;93(7):37–51. doi: 10.1177/0022034514528333.
56. Kurita K, Westesson P-L, Yuasa H, et al. Natural Course of Untreated Symptomatic Temporomandibular Joint Disc Displacement without Reduction. *Journal of Dental Research*. 1998;77(2):361–5. doi: 10.1177/00220345980770020401.

57. Wilkes CH. Internal Derangements of the Temporomandibular Joint: Pathological Variations. *Archives of Otolaryngology-Head and Neck Surgery*. 1989;115(4):469-77. doi:10.1001/archoto.1989.01860280067019.
58. Dıraçoğlu D, Saral İB, Keklik B, et al. Arthrocentesis versus nonsurgical methods in the treatment of temporomandibular disc displacement without reduction. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2009;108(1):3-8. doi: 10.1016/j.tripleo.2009.01.005.
59. Vos LM, Huddleston Slater JJR, Stegenga B. Arthrocentesis as initial treatment for temporomandibular joint arthropathy: A randomized controlled trial. *Journal of Cranio-Maxillofacial Surgery*. 2014;42(5):134-9. doi: 10.1016/j.jcms.2013.07.010.
60. Israel HA, Behrman DA, Friedman JM, et al. Rationale for Early Versus Late Intervention With Arthroscopy for Treatment of Inflammatory/Degenerative Temporomandibular Joint Disorders. *Journal of Oral and Maxillofacial Surgery*. 2010;68(11):2661-7. doi: 10.1016/j.joms.2010.05.051.
61. Muñoz-Guerra MF, Rodríguez-Campo FJ, Escorial Hernández V, et al. Temporomandibular Joint Disc Perforation: Long-Term Results After Operative Arthroscopy. *Journal of Oral and Maxillofacial Surgery*. 2013;71(4):667-76. doi: 10.1016/j.joms.2012.12.013.
62. Tzanidakis K, Sidebottom AJ. Outcomes of open temporomandibular joint surgery following failure to improve after arthroscopy: is there an algorithm for success? *British Journal of Oral and Maxillofacial Surgery*. 2013;51(8):818-21.
63. Murakami K, Hosaka H, Moriya Y, et al. Short-term treatment outcome study for the management of temporomandibular joint closed lock. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 1995;80(3):253-7. doi: 10.1016/j.bjoms.2013.04.013.
64. Macedo De Sousa B, López-Valverde N, López-Valverde A, et al. Different Treatments in Patients with Temporomandibular Joint Disorders: A Comparative Randomized Study. *Medicina*. 2020;56(3):113. doi: 10.3390/medicina56030113.
65. Nitzan DW, Etsion I. Adhesive force: the underlying cause of the disc anchorage to the fossa and/or eminence in the temporomandibular joint—A new concept. *International Journal of Oral and Maxillofacial Surgery*. 2002;31(1):94-9. doi: 10.1054/ijom.2001.0153.
66. Radin EL, Paul IL, Weisser PA. Joint Lubrication with Artificial Lubricants. *Arthritis & Rheumatism*. 1971;14(1):126-9. doi: 10.1002/art.1780140116.
67. Quinn JH, Bazan NG. Identification of prostaglandin E2 and leukotriene B4 in the synovial fluid of painful, dysfunctional temporomandibular joints. *Journal of Oral and Maxillofacial Surgery*. 1990;48(9):968-71. doi: 10.1016/0278-2391(90)90011-p.
68. Kopp S, Wenneberg B, Haraldson T, et al. The short-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint pain and dysfunction. *Journal of Oral and Maxillofacial Surgery*. 1985;43(6):429-35. doi: 10.1016/s0278-2391(85)80050-1.
69. Korkmaz YT, Altıntaş NY, Korkmaz FM, et al. Is Hyaluronic Acid Injection Effective for the Treatment of Temporomandibular Joint Disc Displacement With Reduction? *Journal of Oral and Maxillofacial Surgery*. 2016;74(9):1728-40. doi: 10.1016/j.joms.2016.03.005.
70. Tuncel U. Repeated sodium hyaluronate injections following multiple arthrocenteses in the treatment of early stage reducing disc displacement of the temporomandibular joint: A preliminary report. *Journal of Cranio-Maxillofacial Surgery*. 2012;40(8):685-9. doi: 10.1016/j.jcms.2011.12.003.
71. Alpaslan C, Bilgihan A, Alpaslan GH, et al. Effect of arthrocentesis and sodium hyaluronate injection on nitrite, nitrate, and thiobarbituric acid-reactive substance levels in the synovial fluid. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2000;89(6):686-90. doi: 10.1067/moe.2000.105518.
72. Bjornland T, Gjaerum Aa, Moystad A. Osteoarthritis of the temporomandibular joint: an evaluation of the effects and complications of corticosteroid injection compared with injection

- with sodium hyaluronate. *Journal of Oral Rehabilitation*. 2007;34(8):583–9. doi: 10.1111/j.1365-2842.2007.01759.x.
73. Bergstrand S, Ingstad HK, Møystad A, et al. Long-term effectiveness of arthrocentesis with and without hyaluronic acid injection for treatment of temporomandibular joint osteoarthritis. *Journal of Oral Science*. 2019;61(1):82–8. doi: 10.2334/josnusd.17-0423.
  74. Cömert Kiliç S, Güngörmüş M. Is arthrocentesis plus platelet-rich plasma superior to arthrocentesis plus hyaluronic acid for the treatment of temporomandibular joint osteoarthritis: a randomized clinical trial. *International Journal of Oral and Maxillofacial Surgery*. 2016;45(12):1538–44. doi: 10.1016/j.ijom.2016.06.009.
  75. Yılmaz O, Korkmaz YT, Tuzuner T. Comparison of treatment efficacy between hyaluronic acid and arthrocentesis plus hyaluronic acid in internal derangements of temporomandibular joint. *Journal of Cranio-Maxillofacial Surgery*. 2019;47(11):1720–7. doi: 10.1016/j.jcms.2019.07.030.
  76. Broussard JS. Derangement, Osteoarthritis, and Rheumatoid Arthritis of the Temporomandibular Joint: Implications, Diagnosis, and Management. *Dental Clinics of North America*. 2005;49(2):327–42. doi: 10.1016/j.cden.2004.10.003.
  77. Poswillo D. Experimental investigation of the effects of intra-articular hydrocortisone and high condylectomy on the mandibular condyle. *Oral Surgery, Oral Medicine, Oral Pathology*. 1970;30(2):161–73. doi: 10.1016/0030-4220(70)90355-5.
  78. Kopp S, Carlsson GE, Haraldson T, et al. Long-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint arthritis. *Journal of Oral and Maxillofacial Surgery*. 1987;45(11):929–35. doi: 10.1016/0278-2391(87)90443-5.
  79. Kopp S, Wenneberg B, Haraldson T, et al. The short-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint pain and dysfunction. *Journal of Oral and Maxillofacial Surgery*. 1985;43(6):429–35. doi: 10.1016/s0278-2391(85)80050-1.
  80. Nitzan DW, Franklin Dolwick M, Heft MW. Arthroscopic lavage and lysis of the temporomandibular joint: A change in perspective. *Journal of Oral and Maxillofacial Surgery*. 1990;48(8):798–801. doi: 10.1016/0278-2391(90)90335-y.
  81. Sewall SR, Ryan DE, Kwon PH, et al. The effects of intra-articular deposition of betamethasone in the goat temporomandibular joint. *Journal of Oral and Maxillofacial Surgery*. 1995;53(12):1435–9. doi: 10.1016/0278-2391(95)90672-x.
  82. Alpaslan GH, Alpaslan C. Efficacy of temporomandibular joint arthrocentesis with and without injection of sodium hyaluronate in treatment of internal derangements. *Journal of Oral and Maxillofacial Surgery*. 2001;59(6):613–8. doi: 10.1053/joms.2001.23368.
  83. Okeson JP. *Management of temporomandibular disorders and occlusion*. 4th ed. St. Louis: Mosby Inc; 1998.
  84. Trieger N, Hoffman CH, Rodriguez E. The effect of arthrocentesis of the temporomandibular joint in patients with rheumatoid arthritis. *Journal of Oral and Maxillofacial Surgery*. 1999;57(5):537–40. doi: 10.1016/s0278-2391(99)90070-8.
  85. Giraddi GB, Siddaraju A, Kumar A, Jain T. Comparison Between Betamethasone and Sodium Hyaluronate Combination with Betamethasone Alone After Arthrocentesis in the Treatment of Internal Derangement of TMJ—Using Single Puncture Technique: A Preliminary Study. *Journal of Maxillofacial and Oral Surgery*. 2015;14(2):403–9. doi: 10.1007/s12663-014-0626-8.
  86. Wenneberg B, Kopp S, Gröndahl HG. Long-term effect of intra-articular injections of a glucocorticosteroid into the TMJ: a clinical and radiographic 8-year follow-up. *Journal of craniomandibular disorders : facial & oral pain*. 1991;5(1):11–8.
  87. Bellamy N, Campbell J, Welch V, et al. *Intraarticular corticosteroid for treatment of osteoarthritis of the knee*. In: Bellamy N, (ed). *Cochrane Database of Systematic Reviews*. Chichester, UK: John Wiley & Sons, Ltd; 2006.

88. Lomonte ABV, de Moraes MG, de Carvalho LO, et al. Efficacy of Triamcinolone Hexacetonide versus Methylprednisolone Acetate Intraarticular Injections in Knee Osteoarthritis: A Randomized, Double-blinded, 24-week Study. *The Journal of Rheumatology*. 2015;42(9):1677–84. doi: 10.3899/jrheum.150297.
89. Kopp S, Wenneberg B, Haraldson T, et al. The short-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint pain and dysfunction. *Journal of Oral and Maxillofacial Surgery*. 1985;43(6):429–35. doi: 10.1016/s0278-2391(85)80050-1.
90. Kopp S, Carlsson GE, Haraldson T, et al. Long-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint arthritis. *Journal of Oral and Maxillofacial Surgery*. 1987;45(11):929–35. doi: 10.1016/0278-2391(87)90443-5.
91. Schindler C, Paessler L, Eckelt U, et al. Severe temporomandibular dysfunction and joint destruction after intra-articular injection of triamcinolone. *Journal of Oral Pathology and Medicine*. 2005;34(3):184–6. doi: 10.1111/j.1600-0714.2004.00247.x.
92. Huang W, Foster JA, Rogachefsky AS. Pharmacology of botulinum toxin. *Journal of the American Academy of Dermatology*. 2000;43(2):249–59. doi: 10.1067/mjd.2000.105567.
93. Rohrbach S, Laskawi R. Botulinum-Toxin in ENT medicine. *Laryngo-Rhino-Otologie*. 2003;82(03):202–18. doi: 10.1055/s-2003-38407.
94. Nuray YA, Ümmügülsüm C. Orofasial Bölgede Botulinum Toksin Uygulamaları . Fırat Üniversitesi Sağlık Bilimleri Tıp Dergisi . 2016;30(1):43–9.
95. Majid OW. Clinical use of botulinum toxins in oral and maxillofacial surgery. *International Journal of Oral and Maxillofacial Surgery*. 2010;39(3):197–207. doi: 10.1016/j.ijom.2009.10.022.
96. Canter HI, Kayıkcioglu A, Aksu M, et al. Botulinum Toxin in Closed Treatment of Mandibular Condylar Fracture. *Annals of Plastic Surgery*. 2007;58(5):474–8. doi: 10.1097/01.sap.0000244987.68092.6e.
97. Scott AB, Rosenbaum A, Collins CC. Pharmacologic weakening of extraocular muscles. *Investigative Ophthalmology*. 1973 Dec;12(12):924–7.
98. Freund BJ, Schwartz M. Relief of Tension-type Headache Symptoms in Subjects with Temporomandibular Disorders Treated with Botulinum Toxin-A. Headache: *The Journal of Head and Face Pain*. 2002;42(10):1033–7. doi: 10.1046/j.1526-4610.2002.02234.x.
99. de Andrés J, Cerda-Olmedo G, Valía JC, et al. Use of Botulinum Toxin in the Treatment of Chronic Myofascial Pain. *The Clinical Journal of Pain*. 2003;19(4):269–75. doi: 10.1097/00002508-200307000-00011.
100. Freund B, Schwartz M. The use of botulinum toxin for the treatment of temporomandibular disorder. *Oral health*. 1998;88(2):32–7.
101. Arezzo JC. Possible Mechanisms for the Effects of Botulinum Toxin on Pain. *The Clinical Journal of Pain*. 2002;18:125–32. doi: 10.1097/00002508-200211001-00003.
102. Baker JS, Nolan PJ. Effectiveness of botulinum toxin type A for the treatment of chronic masticatory myofascial pain. *The Journal of the American Dental Association*. 2017;148(1):33–9. doi: 10.1016/j.adaj.2016.09.013.
103. Elfving L, Helkimo M, Magnusson T. Prevalence of different temporomandibular joint sounds, with emphasis on disc-displacement, in patients with temporomandibular disorders and controls. *Swedish dental journal*. 2002;26(1):9–19.
104. Reston JT, Turkelson CM. Meta-analysis of surgical treatments for temporomandibular articular disorders. *Journal of Oral and Maxillofacial Surgery*. 2003;61(1):3–10. doi: 10.1053/joms.2003.50000.
105. Moller E. The chewing apparatus. An electromyographic study of the action of the muscles of mastication and its correlation to facial morphology. *Acta physiologica Scandinavica Supplementum*. 1966;280:1–229.

106. Fujita S, Iizuka T, Dauber W. Variation of heads of lateral pterygoid muscle and morphology of articular disc of human temporomandibular joint - anatomical and histological analysis. *Journal of Oral Rehabilitation*. 2001;28(6):560–71. doi: 10.1046/j.1365-2842.2001.00691.x.
107. Bakke M, Moller E, Werdelin LM, et al. Treatment of severe temporomandibular joint clicking with botulinum toxin in the lateral pterygoid muscle in two cases of anterior disc displacement. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2005;100(6):693–700. doi: 10.1016/j.tripleo.2004.11.019.
108. Vázquez Bouso O, Forteza González G, Mommsen J, et al. Neurogenic temporomandibular joint dislocation treated with botulinum toxin: report of 4 cases. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2010;109(3):33–7. doi: 10.1016/j.tripleo.2009.10.046.
109. Daelen B, Thorwirth V, Koch A. Treatment of recurrent dislocation of the temporomandibular joint with type A botulinum toxin. *International Journal of Oral and Maxillofacial Surgery*. 1997;26(6):458–60. doi: 10.1016/s0901-5027(97)80014-8.
110. Fu K-Y, Chen H-M, Sun Z-P, et al. Long-term efficacy of botulinum toxin type A for the treatment of habitual dislocation of the temporomandibular joint. *British Journal of Oral and Maxillofacial Surgery*. 2010;48(4):281–4. doi: 10.1016/j.bjoms.2009.07.014.
111. Moore AP, Wood GD. Medical treatment of recurrent temporomandibular joint dislocation using botulinum toxin A. *British Dental Journal*. 1997;183(11):415–7. doi: 10.1038/sj.bdj.4809523.
112. Martínez-Pérez D, Ruiz-Espiga PG. Recurrent temporomandibular joint dislocation treated with botulinum toxin: report of 3 cases. *Journal of Oral and Maxillofacial Surgery*. 2004;62(2):244–6. doi: 10.1016/j.joms.2003.04.014.
113. Martínez-Pérez D, Ruiz-Espiga PG. Recurrent temporomandibular joint dislocation treated with botulinum toxin: report of 3 cases. *Journal of Oral and Maxillofacial Surgery*. 2004;62(2):2. doi: 10.1016/j.joms.2003.04.014.
114. Smyth NA, Murawski CD, Fortier LA, et al. Platelet-Rich Plasma in the Pathologic Processes of Cartilage: Review of Basic Science Evidence. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. 2013;29(8):1399–409. doi: 10.1016/j.arthro.2013.03.004.
115. Marx RE. Platelet-rich plasma: evidence to support its use. *Journal of Oral and Maxillofacial Surgery*. 2004;62(4):489–96. doi: 10.1016/j.joms.2003.12.003.
116. Everts PAM, Knape JTA, Weibrich G, et al. Platelet-rich plasma and platelet gel: a review. *The Journal of Extra-Corporeal Technology*. 2006;38(2):174–87.
117. Bocanegra-Pérez S, Vicente-Barrero M, Knezevic M, et al. Use of platelet-rich plasma in the treatment of bisphosphonate-related osteonecrosis of the jaw. *International Journal of Oral and Maxillofacial Surgery*. 2012;41(11):1410–5. doi: 10.1016/j.ijom.2012.04.020.
118. Sun Y, Feng Y, Zhang CQ, et al. The regenerative effect of platelet-rich plasma on healing in large osteochondral defects. *International Orthopaedics*. 2010;34(4):589–97. doi: 10.1007/s00264-009-0793-2.
119. Kon E, Filardo G, Delcogliano M, et al. Platelet autologous growth factors decrease the osteochondral regeneration capability of a collagen-hydroxyapatite scaffold in a sheep model. *BMC Musculoskeletal Disorders*. 2010 Dec 27;11(1):220. doi: 10.1186/1471-2474-11-220.
120. Lee H-R, Park KM, Joung YK, et al. Platelet-rich plasma loaded in situ -formed hydrogel enhances hyaline cartilage regeneration by CB1 upregulation. *Journal of Biomedical Materials Research Part A*. 2012;100A(11):3099–107. doi: 10.1002/jbm.a.34254.
121. Akeda K, An HS, Okuma M, et al. Platelet-rich plasma stimulates porcine articular chondrocyte proliferation and matrix biosynthesis. *Osteoarthritis and Cartilage*. 2006;14(12):1272–80. doi: 10.1016/j.joca.2006.05.008.

122. van Buul GM, Koevoet WLM, Kops N, et al. Platelet-Rich Plasma Releasate Inhibits Inflammatory Processes in Osteoarthritic Chondrocytes. *The American Journal of Sports Medicine*. 2011;39(11):2362–70. doi: 10.1177/0363546511419278.
123. Hegab AF, Ali HE, Elmasry M. Platelet-Rich Plasma Injection as an Effective Treatment for Temporomandibular Joint Osteoarthritis. *Journal of Oral and Maxillofacial Surgery*. 2015;73(9):1706–13. doi: 10.1016/j.joms.2015.03.045.
124. Kütük N, Baş B, Soylu E, et al. Effect of Platelet-Rich Plasma on Fibrocartilage, Cartilage, and Bone Repair in Temporomandibular Joint. *Journal of Oral and Maxillofacial Surgery*. 2014;72(2):277–84. doi: 10.1016/j.joms.2013.09.011.
125. Cömert Kiliç S, Güngörmüş M, Sümbüllü MA. Is Arthrocentesis Plus Platelet-Rich Plasma Superior to Arthrocentesis Alone in the Treatment of Temporomandibular Joint Osteoarthritis? A Randomized Clinical Trial. *Journal of Oral and Maxillofacial Surgery*. 2015;73(8):1473–83. doi: 10.1016/j.joms.2015.02.026.
126. Hancı M, Karamese M, Tosun Z, et al. Intra-articular platelet-rich plasma injection for the treatment of temporomandibular disorders and a comparison with arthrocentesis. *Journal of Cranio-Maxillofacial Surgery*. 2015;43(1):162–6. doi: 10.1016/j.jcms.2014.11.002.
127. Coskun U, Candirli C, Kerimoglu G, et al. Effect of platelet-rich plasma on temporomandibular joint cartilage wound healing: Experimental study in rabbits. *Journal of Cranio-Maxillofacial Surgery*. 2019;47(2):357–64. doi: 10.1016/j.jcms.2018.12.004.
128. Dohan DM, Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part I: Technological concepts and evolution. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2006;101(3):37–44. doi: 10.1016/j.tripleo.2005.07.008.
129. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). *Trends in Biotechnology*. 2009;27(3):158–67. doi: 10.1016/j.tibtech.2008.11.009.
130. Torul D, Cezairli B, Kahveci K. The efficacy of intra-articular injectable platelet-rich fibrin application in the management of Wilkes stage III temporomandibular joint internal derangement. *International Journal of Oral and Maxillofacial Surgery*. 2021;50(11):1485–90. doi: 10.1016/j.ijom.2021.03.004.
131. Choukroun J, Diss A, Simonpieri A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part IV: Clinical effects on tissue healing. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2006;101(3):e56–60. doi: 10.1016/j.tripleo.2005.07.011.
132. Albilal J, Herrera-Vizcaino C, Weisleder H, et al. Liquid platelet-rich fibrin injections as a treatment adjunct for painful temporomandibular joints: preliminary results. *Cranio : the journal of craniomandibular practice*. 2020;38(5):292–304. doi: 10.1080/08869634.2018.1516183.
133. Choukroun J, Ghanaati S. Reduction of relative centrifugation force within injectable platelet-rich-fibrin (PRF) concentrates advances patients' own inflammatory cells, platelets and growth factors: the first introduction to the low speed centrifugation concept. *European Journal of Trauma and Emergency Surgery*. 2018 Feb 10;44(1):87–95. doi: 10.1007/s00068-017-0767-9.
134. Yuce E, Komerik N. Comparison of the Efficacy of Intra-Articular Injection of Liquid Platelet-Rich Fibrin and Hyaluronic Acid After in Conjunction With Arthrocentesis for the Treatment of Internal Temporomandibular Joint Derangements. *Journal of Craniofacial Surgery*. 2020 Oct;31(7):1870–4. doi: 10.1097/SCS.0000000000006545.