

Ist die Theorie der terminalen Scharnierachse ein Mythos?

Biomechanische Implikationen des Echtzeit-MRT-Verfahrens für Zahnmedizin und Zahntechnik

von Dr. med. dent. Sebastian Krohn, Professor Dr. med. Dr. med. dent. Peter Proff, Professor Dr. med. dent. Dietmar Kubein-Meesenburg, PD Dr. med. dent. Eva Paddenberg-Schubert.*

*Alle Autoren: Poliklinik für Kieferorthopädie, Universitätsklinikum Regensburg

Literatur

1. Roberts WE, Stocum DL. Part II: Temporomandibular joint (TMJ)—Regeneration, degeneration, and adaptation. *Current Osteoporosis Reports* 2018;16:369-379.
2. Scapino RP, Obrez A, Greising D. Organization and function of the collagen fiber system in the human temporomandibular joint disk and its attachments. *Cells Tissues Organs* 2006;182:201-225.
3. Osborn J. The disc of the human temporomandibular joint: design, function and failure. *Journal of oral rehabilitation* 1985;12:279-293.
4. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic criteria for temporomandibular disorders (DC/TMD) for clinical and research applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. *Journal of oral & facial pain and headache* 2014;28:6.
5. Behzadi F, Mandell JC, Smith SE, Guenette JP. Temporomandibular joint imaging: current clinical applications, biochemical comparison with the intervertebral disc and knee meniscus, and opportunities for advancement. *Skeletal radiology* 2020;49:1183-1193.
6. Bell KA, D. MK, and Jones JP. Cine Magnetic Resonance Imaging of the Temporomandibular Joint. *CRANIO®* 1992;10:313-317.
7. Kling O, Rödiger M, Zhang S, Frahm J, Gersdorff N. Real-time MRI as a new technique for the functional assessment of the temporomandibular joint. *Journal of Craniomandibular Function* 2013;5:9-18.
8. Sutter B, Radke J. The complementary diagnostic relationship between Jaw Tracking and MR Imaging. *Advanced Dental Technologies & Techniques* 2020.
9. Garetier M, Borotikar B, Makki K, Brochard S, Rousseau F, Ben Salem D. Dynamic MRI for articulating joint evaluation on 1.5 T and 3.0 T scanners: setup, protocols, and real-time sequences. *Insights into Imaging* 2020;11:1-10.
10. Mehl A. Is it possible to detect a true rotation axis of the temporomandibular joint with common pantographic methods? A fundamental kinematic analysis. *Computer methods in biomechanics and biomedical engineering* 2020;23:445-455.
11. De Stefano M, Ruggiero A. A Critical Review of Human Jaw Biomechanical Modeling. *Applied Sciences* 2024;14:3813.

12. Winstanley R. The hinge-axis: a review of the literature. *Journal of oral rehabilitation* 1985;12:135-159.
13. Posselt U. Terminal hinge movement of the mandible. *The Journal of Prosthetic Dentistry* 1957;7:787-797.
14. Wadsworth F. Mandibular movements, occlusion and correlation of orthodontia and prosthodontia. *International Journal of Orthodontics, Oral Surgery and Radiography* 1925;11:327-336.
15. Luce CE. The movements of the lower jaw. *The Boston Medical and Surgical Journal* 1889;121:8-11.
16. Krohn S, Frahm J, Mahler A, et al. Biomechanical analysis of temporomandibular joint dynamics based on real-time magnetic resonance imaging. *Int J Comput Dent* 2020;23:235-244.
17. Sadat-Khonsari R, Fenske C, Kahl-Nieke B, Kirsch I, Jüde HD. Mandibular instantaneous centers of rotation in patients with and without temporomandibular dysfunction. *Journal of Orofacial Orthopedics= Fortschritte der Kieferorthopadie: Organ/official Journal Deutsche Gesellschaft fur Kieferorthopadie* 2003;64:256-264.
18. Uecker M, Zhang S, Voit D, Karaus A, Merboldt KD, Frahm J. Real-time MRI at a resolution of 20 ms. *NMR in Biomedicine* 2010;23:986-994.
19. Krohn S, Gersdorff N, Wassmann T, et al. Real-time MRI of the temporomandibular joint at 15 frames per second—A feasibility study. *European Journal of Radiology* 2016;85:2225-2230.
20. Krohn S, Joseph AA, Voit D, et al. Multi-slice real-time MRI of temporomandibular joint dynamics. *Dentomaxillofacial Radiology* 2019;48:20180162.
21. Jász B, Balogh T, Ambrus S, et al. Pure rotation in the temporomandibular joint during jaw opening? A digital motion analysis. *BDJ open* 2024;10:32.