Efficacy of Kinematic Parameters for Assessment of Temporomandibular Joint Function and Disfunction: A Systematic Review and Meta-Analysis

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Table S1. Characteristic Table.

Study	Year	Country	Sample/Sex	Age	Outcomes	Study design	Sponsorship	Diagnostic tool
Bernhard et al. [1]	2003	GER	30 M:19 F:11	21 to 26	Condylar trajectories	Case series	NR	Axhiography
Ghodsi et al. [2]	2018	IR	50 M:33 F:17	26	Condylar trajectories	Case series	NR	Axhiography
Hirai et al. [3]	2009	JAP	22 M:NR F:NR	25 to 68	Incisal trajectories	Case control study	NR	Axhiography
Hue et al. [4]	2011	FRA	60 M: 26 F:34	58 to 64	Condylar angle	Case series study	NR	Axhiography
Sadat Koshari et al. [5]	2003	GER	30 M:11 F:19	Test: 21 ± 7 Control: 17.9 ÷ 7.2	Condylar trajectories	Case control study	NR	Axhiography
Sadat Koshari et al. [6]	2003	GER	8 M:4 F:4	21.8 ± 8.0	Helical axis trajectories	Case series	NR	Axhiography
Tamaki et al. [7]	1997	JAP	45 M:10 F:35	13 to 62	Condylar trajectories, hinge axis	Case series	NR	Axhiography
Wieckiewicz et al. [8]	2014	POL	35 M:0 F:35	10 to 35	Condylar path inclination	Case series	NR	Axhiography

Baqaien et al. [9]	2007	GER	213 M:103 F:110	6.5 to 12.9	Condylar path inclination	Cohort study	NR	Ultrasonic tracking
Kiseri et al. [10]	2018	TUR	35 M.13 F:22	7 to 11	Condylar trajectories	Case series	Scientific Research Projects Coordination Unit of Istanbul University	Ultrasonic tracking
Ko et al. [11]	2012	JAP	50 M:16 F:34	Test: 25.6 ± 3.7 Control: 25.7 ± 5.1	Condylar trajectories	Case control study	NR	Ultrasonic tracking
Ko et al. [12]	2015	JAP	21 M:7 F:14	25.5 ± 4.7	Condylar trajectories, incisal trajectories	Cohort study	NR	Ultrasonic tracking
Kordab et al. [13]	2014	GER	259 M:100 F:159	NR	Condylar path inclination	Case series	NR	Ultrasonic tracking
Linsen et al. [14]	2016	GER	36 M:8 F:28	28.03 ± 6.58	Condylar trajectories, incisal trajectories	Case series	the Department of Prosthodontics, Preclinical Education and Dental Material Science, University Hospital Bonn.	Ultrasonic tracking
Linsen et al. [15]	2021	GER	39 M:15 F.24	48.9 ± 16.2	Condylar trajectories, incisal trajectories	Cohort study	NR	Ultrasonic tracking
Ratzmann et al. [16]	2007	GER	23 M:11 F:12	46.7	Condylar inclination angle	Case series	NR	Ultrasonic tracking
Reichender et al. [17]	2013	GER	132 M:68 F:64	7.2 to 10.6	MMO CPIA	Cohort study	NR	Ultrasonic tracking
Schwestka-Polly et al. [18]	1999	GER	40 M:NR F:NR	NR	Mandibular rotation	Case control study	NR	Ultrasonic tracking
Stiesch-Scholz et al. [19]	2006	GER	60 M:NR F:NR	NR	Condylar trajectories	Case control study	NR	Ultrasonic tracking
Teng et al. [20]	2015	JAP	63 M:17 F:46	NR	Condylar and incisal trajectories	Cohort study	grant (CMRPG 381623) from Chang Gung Memorial Hospital	Ultrasonic tracking

Wang et al. [21]	2009	CHI	44 M:23 F:21	Test: 23.1 Control:22.5	Condylar trajectories	Cohort study	NR	Ultrasonic tracking
Yen at al. [22]	2017	CHI	20 M:18 F:2	Test: 28.9 ± 2.4 Control: 29.4 ± 3.2	Condylar trajectories	Cohort study	NR	Ultrasonic tracking
Baeyens et al. [23]	2013	CH	12 M:5 F:7	NR	Condylar and helical axis trajectories	Case series	NR	Magnetic Tracking
Baltali et al. [24]	2008	TUR	5 M:0 F:5	NR	Condylar and incisal trajectories	Case series	NR	Magnetic Tracking
Keller et al. [25]	2012	USA	36 M:2 F:34	46	Condylar, incisal and helical axis trajectories	Cohort study	NR	Magnetic Tracking
Minami et al. [26]	2018	JAP	14 M:6 F:8	NR	Incisal trajectories and mandibular rotation	Case series	Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science	Magnetic Tracking
Yamamoto et al. [27]	2009	JAP	25 M:15 F:5	29.3 ± 12.3	Intraarticular distance	Case series	NR	Magnetic Tracking
Chang et al. [28]	2015	JAP	26 M:10 F:16	19 to 25	Intraarticular distance	Cohort study	grant (HI13C1491) from the Korea Health Technology R&D Project, Ministry of Health and Welfare, Republic of Korea	Optoelectronic tracking
Ettlin et al. [29]	2008	CH	10 M:5 F:5	18 to 31	Intraarticular distance, condilar tajectories	Case series	standard financial plan of the University of Zürich and by Grant of the Swiss National Science Foundation	Optoelectronic tracking
Fushima et al. [30]	2003	JAP	10 M:3 F:7	NR	Intraarticular distance	Case series	The standard financial	Optoelectronic tracking

							plan of the University of Zurich.	
Gallo et al. [31]	2008	CH	11 M:4 F:7	28 to 38	Intraartic ular distance, condilar tajectories	Case series	standard financial plan of the University of Zürich and by Grant of the Swiss National Science Foundation	Optoelectronic tracking
Goto et al. [32]	2001	NED	4 M:4 F:0	30 to 35	Muscular lenght	Case series	MRC (Canada)*	Optoelectronic tracking
Hayasaki et al. [33]	2008	JAP	20 M:0 F:20	19 to 27	Mandibul ar rotation	Case series	Japanese society for the promotion of science	Optoelectronic tracking
Kim et al. [34]	2013	KOR sud	15 M:4 F:11	F: 21.4 M: 26.3	Condylar trajectorie s	Case series	Industrial Strategic Technology Development Program and the research Grant from the Seoul National University	Optoelectronic tracking
Kim et al. [35]	2010	KOR sud	16 M:6 F:8	17 to 27	Condylar trajectorie s	Case series	NR	Optoelectronic tracking
Kubota et al. [36]	2010	JAP	48 M:11 F:37	Test: 5.9 Control: 25.9	Condylar trajectorie s and cycle masticati on data	Cohort study	Kakenhi from Japan society for the promotion of science	Optoelectronic tracking
Leader et al. [37]	2003	USA	6 M:3 F3:	20 to 47	Condylar trajectorie s	Case series	NIDCR grant from the National Institutes of Health, Bethesda, USA	Optoelectronic tracking
Wojczynska et al. [38]	2019	CH	5 M:1 F:4	22 to 61	Condylar trajectorie s	Case series	grant from the AO Foundation, Du¨bendorf, Switzerland	Optoelectronic tracking
Yashiro et al. [39]	2015	JAP	20 M:0 F:20	18 to 36	Condylar trajectorie s and intraartic ular joint space	Case series	Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Science and Culture.	Optoelectronic tracking
Yashiro et al. [40]	2015	JAP	10 M.0 F:10	24 to 33	Condylar trajectorie	Case series	Grant-in-Aid for Scientific Research	Optoelectronic tracking

					s and intraarticular joint space		from the Japanese Ministry of Education, Science and Culture.	
Zaugg et al. [41]	2012	CH	6 M:4 F:2	54 to 71	Condylar trajectories and intraarticular joint space	Case series	standard financial plan of the University of Zurich	Optoelectronic tracking
Abbink et al. [42]	1999	NED	8 M:4 F:4	20 to 50	Mandibular traslation	Case series	Faculty of Medicine of the Utrecht University and the Netherlands Institute for Dental Sciences	3D scanning
Amhamed et al. [43]	2016	AUS	14 M:9 F:5	33.8 ± 3.8	Mandibular traslation	Case series	NR	3D scanning
Bhaskaracharya et al. [44]	2015	AUS	31 M:8 F:23	Test: 49 to 76 Control: 50 to 78	Incisal trajectories	Case control study	Australian Dental Research Foundation	3D scanning
Buschang et al. [45]	2001	USA	27 M:0 F:27	23 to 35	Condylar and incisal trajectories	Case series	Center for Craniofacial Research and Diagnosis, Baylor College of Dentistry,	3D scanning
Buschang et al. [46]	2000	USA	26 M:15 F:11	20 to 35	mastication cycle data	Cohort study	NR	3D scanning
Calixtre et al. [47]	2017	BRA	36 M:19 F:17	23.92 ± 2.8	Condylar trajectories	Case series	São Paulo Research Foundation	3D scanning
Catic, Naeije [48]	1999	CRO	40 M:13 F:27	Test: 16 to 61 Control: 21 to 33	Hinge axis	Case control study	NR	3D scanning
Coutant et al. [49]	2008	FRA	32	NR	Condylar trajectories	Case series	CNRS UMR 5227 Laboratoire Mouvement Adaptation Cognition'' (CHIEDI)	3D scanning
Crane et al. [50]	2013	USA	22 M.2 F:20	10 to 58	Mandibular translatio	Case series	Grants awarded to GEG from the National Institutes of Health.	3D scanning

					n and velocity			
De felicio et al. [51]	2013	ITA	20 M:8 F: 12	Test: 27.3 ± 7.8 Control: 31.9 ± 16.3	Condylar and incisal trajectories, cycle mastication data	Case control study	Fundação de Amparo a Pesquisa do Estado de São Paulo, Brazil	3D scanning
Ferrario et al. [52]	2005	ITA	27: M:12 F:15	19 to 30	incisal trajectories	Case series	NR	3D scanning
Gallo et al. [53]	1997	CH	30 M:17 F:13	10 to 34	FHA fluctuation MMO	Case series	standard financial plan of the University of Zurich	3D scanning
Gallo et al. [54]	2000	CH	7 M:2 F:5	22 to 38	Helical axis trajectories	Case series	standard financial plan of the University of Zurich	3D scanning
Gallo et al. [55]	2006	CH	50 M:12 F:38	Test: 26 to 51 Control: 25 to 39	Finite Helical axis Fluctuation	Case control study	standard financial plan of the University of Zurich	3D scanning
Gerstner et al. [56]	2005	USA	46 M:13 F:33	19 to 62	mandibular trajectories	Case series	USPHS Research Grant from the National Institute of Dental Research.	3D scanning
Hayashi et al. [57]	2009	JAP	10 M:5 F:5	NR	Finite helical axis	Case series	NR	3D scanning
Hayashi et al. [58]	2012	JAP	10 M:7 F:3	25±7.0	Finite helical axis	Case series	Grant-in-Aid for Young Scientists from the Japan Society for the Promotion of Science	3D scanning
Leader et al. [59]	1997	USA	20 M:3 F:17	31.2 ± 11.2	Incisal trajectories	Case series	NIH grant	3D scanning
Lemoine et al. [60]	2005	USA	10 M:5 F:5	21 to 47	Mandibula centre of rotation	Case series	NR	3D scanning
Lewis et al. [61]	2001	USA	56 M:29 F:27	Test: 23 to 39 Control: 23 to 35	Kinematic hinge axis and incisal	Case control study	NR	3D scanning

					trajectories		
Lobezoo et al. [62]	2000	NED	5 M:5 F:0	20 to 25	Condylar traslation and rotation	Case series	Netherlands Institute for Dental Sciences (IOT)	3D scanning
Mapelli et al. [63]	2009	ITA	26 M:12 F:14	19 to 30	Condylar trajectories	Cohort study	NR	3D scanning
Mapelli et al. [64]	2016	ITA	40 M:5 F:35	Test: 18 to 34 Control: 20 to 31	Condylar and incisal trajectories	Case control study	Provost's Office for Research of the University of Sao Paulo, Brazil, and Nacional Council for Scientific and Technological Development	3D scanning
Naeije [65]	2002	NED	35 M:17 F:18	18 to 31	Condylar translation and rotation	Case series	NR	3D scanning
Naeije e Hofman [66]	2003	NED	10 M:5 F:5	21 to 33	Condylar trajectories	Case series	Netherlands Institute of Dental Sciences (IOT)	3D scanning
Ostry et al. [67]	1997	CAN	5 M:5 F:0	NR	Kinematic hinge axis	Case series	NIH grant from the National Institute on Deafness and Other Communication Disorders, USA; ATR Human Information Processing Research Laboratories, Japan, NSERC-Canada, FCAR, Quebec	3D scanning
Ogawa et al. [68]	1998	JAP	41 M:16 F:25	19 to 28	Incisal trajectories	Case series	NR	3D scanning
Remijn et al. [69]	2017	NED	22 M:9 F:13	Test: 17 to 31 Control: 28 to 32	Mandibular trajectories and mastication cycle data	Case control study	NR	3D scanning
Sforza et al. [70]	2009	ITA	9 M:8 F:1	18 to 58	Condylar translatio	Cohort study	Annual grant from Milan University	3D scanning

					n and rotation			
Sforza et al. [71]	2010	ITA	58 M:28 F:30	24	Kinematic hinge axis	Case control study	NR	3D scanning
Sforza et al. [72]	2011	ITA	46 M:23 F:23	18 to 50	Incisal trajectories	Case control study	NR	3D scanning
Shiller et al. [73]	1999	CAN	7 M:2 F:5	NR	Mandibular translation and rotation	Case series	NR	3D scanning
Shiller et al. [74]	2000	FRA	8	NR	Mandibular rotation	Case series	NR	3D scanning
Siegler et al. [75]	1991	USA	3	NR	Condylar trajectories	Case series	NR	3D scanning
Slater et al. [76]	1999	NED	10 M:4 F:6	20 to 32	Condylar trajectories	Case series	Netherlands Institute of Dental Sciences (IOT).	3D scanning
Tomonari et al. [77]	2017	JAP	32 M:22 F:10	19 to 25	Condylar trajectories	Case series	JSPS KAKENHI	3D scanning
Travers et al. [78]	2000	JAP	27 M:0 F:27	23 to 35	Condylar and incisal trajectories	Case series	Center for Craniofacial Research and Diagnosis, Baylor College of Dentistry, a Member of the Texas A&M University System Health Science Center	3D scanning
Ugolini et al. [79]	2017	ITA	18 M:6 F:12	Test: 24 to 48 Control: 21 to 45	Condylar and incisal trajectories	Case control study	NR	3D scanning
Ugolini et al. [80]	2018	ITA	31 M:12 F:19	Test:22 to 48 Control: 19 to 29	Mandibular translation and rotation	Case control study	NR	3D scanning
Visscher et al. [81]	2000	NED	10 M:4 F:6	20 to 32	Condylar trajectories	Case series	NR	3D scanning

Zhao et al. [82]	2012	AUS	26 M:12 F:14	Test: 29.5 ± 4.9 Control: 29.6 ± 3.4	Incisal trajectories and mastication cycle data	Case control study	Postgraduate Scholarship in Neuroscience of the University of Sidney and the National Healt and Medical Research Council of Australia	3D scanning
Dos Santos [83]	2019	BRA	12 M:6 F:6	22.2 ± 4.7	Condylar trajectories	Case series	NR	Ultrasonic tracking
Dos Santos [84]	2021	BRA	184 M:44 F: 140	18 to 45	Condylar trajectories	Cross sectional	Department of Postgraduate Program in Rehabilitation Sciences, Universidade Nove de Julho— UNINOVE.	Mechanical linkage system
Ernst et al. [85]	2019	GER	13 M:0 F:13	21 to 31	Mandibular rotation	Case series	Deutsche Forschungsgemeins chaft	Ultrasonic tracking
Chen et al. [86]	2020	TW	10 M:5 F:5	32.3 ± 8.5	Mandibular rotation	Cross sectional	NR	3d fluoroscopy
Leissner et al. [87]	2021	CHI	476 M:92 F:384	31.03 ± 15.8	Condylar trajectories	Case series	NR	Mechanical linkage system
Choi et al. [88]	2020	USA	23	12.8 to 16.7	Incisal trajectories	Cohort study	NR	
Feng et al. [89]	2021	CHINA	6 M:4 F:3	21.7 ± 1.25	Condylar trajectories	Case series	National Natural Science Foundation of China, Strategic cooperation project be- tween Sichuan University and Yibin municipal people's government and Fundamental Research Funds for the Central Universities of China.	Optoelectronic tracking
Shu et al. [90]	2020	CHINA	5 M:3 F:2	20.6 ± 2.4	Condylar trajectories	Case series	NR	Video motion analysis

| Shu et al. [91] | 2021 | CHINA | 13 M:10 F:3 | 21.8 ± 2.1 | Condylar trajectories | Case series | National Natural Science Foundation of China, Strategic cooperation project between Sichuan University and Yibin municipal people's government, the Innovative Spark Project of Sichuan University, the Technology Innovation Project of Science and Technology Bureau of Chengdu, and Fundamental Research Funds for the Central Universities of China. | Optoelectronic tracking |

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